THE NATION'S LONG-TERM AGRICULTURE RESEARCH NEEDS

HEARINGS

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

NINETY-SEVENTH CONGRESS

SECOND SESSION

JULY 27, 29, 1982

[No. 152]

Printed for the use of the Committee on Science and Technology

U.S. GOVERNMENT PRINTING OFFICE

11-864 O WASHINGTON : 1983

H701-29

COMMITTEE ON SCIENCE AND TECHNOLOGY

DON FUQUA, Florida, *Chairman*

ROBERT A. ROE, New Jersey
GEORGE E. BROWN, Jr., California
JAMES H. SCHEUER, New York
RICHARD L. OTTINGER, New York
TOM HARKIN, Iowa
MARILYN LLOYD BOUQUARD, Tennessee
JAMES J. BLANCHARD, Michigan
TIMOTHY E. WIRTH, Colorado*
DOUG WALGREN, Pennsylvania
RONNIE G. FLIPPO, Alabama
DAN GLICKMAN, Kansas
ALBERT GORE, Jr., Tennessee
ROBERT A. YOUNG, Missouri
RICHARD C. WHITE, Texas
HAROLD L. VOLKMER, Missouri
HOWARD WOLPE, Michigan
BILL NELSON, Florida
STANLEY N. LUNDINE, New York
ALLEN E. ERTEL, Pennsylvania
BOB SHAMANSKY, Ohio
RALPH M. HALL, Texas
DAVE McCURDY, Oklahoma
MERVYN M. DYMALLY, California

LARRY WINN, Jr., Kansas
BARRY M. GOLDWATER, Jr., California
HAMILTON FISH, Jr., New York
MANUEL LUJAN, New Mexico
HAROLD C. HOLLENBECK, New Jersey
ROBERT S. WALKER, Pennsylvania
EDWIN B. FORSYTHE, New Jersey
WILLIAM CARNEY, New York
MARGARET M. HECKLER, Massachusetts
F. JAMES SENSENBRENNER, Jr., Wisconsin
VIN WEBER, Minnesota
JUDD GREGG, New Hampshire
RAYMOND J. McGRATH, New York
JOE SKEEN, New Mexico
CLAUDINE SCHNEIDER, Rhode Island
JIM DUNN, Michigan
BILL LOWERY, California

HAROLD P. HANSON, *Executive Director*
ROBERT C. KETCHAM, *General Counsel*
REGINA A. DAVIS, *Administrator*
GERALD E. JENKS, *Minority Staff Director*

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

JAMES H. SCHEUER, New York, *Chairman*

GEORGE E. BROWN, Jr., California
JAMES J. BLANCHARD, Michigan
DOUG WALGREN, Pennsylvania
RICHARD C. WHITE, Texas

WILLIAM CARNEY, New York
F. JAMES SENSENBRENNER, Jr., Wisconsin
CLAUDINE SCHNEIDER, Rhode Island

---

*On assignment to Budget Committee for 97th Congress.

CONTENTS

WITNESSES

	Page
July 27, 1982:	
T. B. Kinney, Acting Assistant Secretary for Science and Education, U.S. Department of Agriculture, accompanied by Mary E. Carter, Associate Administrator, Agricultural Research Service; and Clare I. Harris, Deputy Administrator, Plant Science, Cooperative State Research Service	4
Charles C. Kidd, dean, school of agriculture, Florida A&M University; Kenneth Wing, State agricultural experimental stations, University of Maine; and Handy Williamson, director, cooperative agriculture research program, Tennessee State University	182
Mike Phillips, Food and Agricultural Research, Office of Technology Assessment; and William Gahr, Associate Director, Community and Economic Development Division, General Accounting Office	196
July 29, 1982:	
Denis J. Prager, Assistant Director, Office of Science and Technology Policy, Executive Office of the President; John L. Brooks, Division Director, Environmental Biology, National Science Foundation, accompanied by H. T. Huang, Program Manager, Alternate Biological Resources Program, National Science Foundation; and Emery Castle, president, resources for the future	243
James E. Tillotson, Ph. D., vice president, technical research and development, Ocean Spray Cranberries, Inc., and Harold L. Wilcke, Ph. D., retired, vice president for research, Ralston Purina Co	307
Appendix	331

THE NATION'S LONG-TERM AGRICULTURE RESEARCH NEEDS

TUESDAY, JULY 27, 1982

HOUSE OF REPRESENTATIVES, COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND DEVELOPMENT

Washington, D.C.

The subcommittee met, pursuant to call, at 9 a.m., in room 2318, Rayburn House Office Building, Hon. James H. Scheuer (chairman of the subcommittee) presiding.

Present: Representatives Scheuer, White, Fuqua, and Sensenbrenner.

Staff present: Dr. Greene.

Mr. SCHEUER. The Subcommittee on Natural Resources, Agriculture Research and Environment will come to order.

Today, we are beginning hearings on this country's long-term agricultural research needs. Additionally, we will examine the kind of agricultural research that our country ought to be doing to help farmers, as well as to assist populations in the Third World countries. We are interested in hearing about the kinds of new processes, new plants, new fibers, new applications of appropriate technology that farmers, here and in the Third World, need in order to produce more efficiently and effectively the food needed to feed the Earth's exploding populations, now and in the forseeable future.

We have had three thoughtful reports in the last year. One was by the Congressional Research Service, one by the GAO, and one was by the Office of Technology Assessment. This is the first congressional hearing that was designed thoughtfully to consider the findings of those three reports. Let me just read to you a sentence or two from each.

The GAO report of last year on long-term planning for agriculture research and development found that,

> The U.S. Agriculture Research and Development system does not naturally perform national long-term planning which would meet or satisfy generally accepted definitions of such planning. Because most planning that is done is not national long-range planning, no rationale for this type of planning has been developed.

The report went on to define long-term planning as containing the elements of establishing goals, selecting strategies for achieving these goals, and setting priorities.

The CRS report—independent of the GAO's study—states that,

> The various interactions between Congress, the Adminstration, college officials, scientists and the public affecting agricultural research has been tortuous and complex since its beginning. Basic policies and institutions have changed little in recent

years, but changing economic and social conditions have altered the scope of the research mission.

Finally, the OTA report of last year in an assessement of U.S. Food and Agricultural Research System said that there is some question as to whether the USDA has a national research program or merely a series of local and regional activities. Consequently, USDA and the State agricultural experiment stations—the SAES's—appear to be working on seemingly identical problems. Many people, including Congress, have voiced concern that little if any overall planning and coordination of research exists especially at top levels of administration. They question whether national issues are receiving adequate attention. Further, there seems to be much duplication and vying for funds.

It does seem to us that our institutional mechanism for achieving long-term national goals in the field of agricultural research can be improved.

The fact we are having these hearings reflects growing concerns that in the decades ahead, the agriculture industry will be facing problems of a magnitude greater than they have ever experienced before and that the available time for which research has to address these problems and come up with workable answers, seems perilously brief.

These problems aren't new, but they are getting more critical. In the July 19 issue of Newsweek, 1 week ago, the seriousness of water supply shortage was described for several areas of the United States. In Texas, underground reservoirs of water are available for agricultural domestic and municipal use, being depleted at a rate twice that of the natural replenishment. This situation is projected to cause water shortages that, by the turn of the century, will seriously threaten the $10 billion agribusiness industry in Texas.

Southern California faces the possibility of equally serious water shortage; and the future supply of water for agriculture there is very uncertain.

In Florida, the water table is being depleted so rapidly that sinkholes such as the 350-foot-wide hole that swallowed a house, five cars and a swimming pool last year are becoming comparatively common phenomena.

Irrigation for agricultural use, for food production, is a major use of water accounting for as much as 70 percent of total water use in some locations.

Another problem, both in this country and abroad, is that of feeding ever-increasing populations. A 1982 OTA report on world population projects that the population of the globe will increase from about 4.5 billion, which it is now, to about 6.5 billion by the end of the century. The statistics of the United Nations fund for population activities, UNFPA, as well as the World Bank and the CIA, all agree on that figure. At that same time, our own population is scheduled to increase from about 225 million, which it is today, to 260 million in the year 2000. Therefore, it seems we will have substantial additional food needs to meet both in this country and the rest of the world, within the next 20 years.

I don't think we should simply improve our own agriculture productivity. I think we have to do the kind of research that is best

conceived and best structured to help the developing world fulfill its own food needs. I think we should accept the role of helping the Third World nations feed themselves, and to consequently help produce the technology that will help them better meet their own food needs.

It is a very serious question as to whether our national agricultural research policy is adequate to assure that these demands are met—either the external international long-term food shortage question or our own expanding population and resultant increase in food needs.

A major problem area is the level of funding for the research that is needed. I call your attention to the chart on my left. It compares the research and development funding for the Department of Defense, the old Department of Health, Education and Welfare, and the U.S. Department of Agriculture, as they relate to all Federal research from 1966 through 1979.

You will note that the most striking aspect of the chart is the infinitesimally low of USDA funding. It is that green line right at the bottom of the chart that is the level of funding that we are giving USDA. It amounts to about 1.5 percent of total research funding compared to 45 percent for the Department of Defense, 16 percent for the Department of Energy, and 12 percent for HEW.

It appears to me that if USDA has the mission of providing for our own national food and nutrition needs over the long term as well as helping us meet whatever moral obligation we have to help developing world countries' populations meet their own food needs, and that if we recognize those as national needs, national missions, the level of funding is painfully, pathetically inadequate.

If the past is any indication of the future, then it is probably that the USDA will not be able to conduct the research needed to resolve the problems that we are about to hear of—on which I have just touched very lightly—without substantial additional funding and without substantial additional structural reorganization. The research system must, it seems, create the institutional mechanisms for defining objectives, declaring priorities, and getting on with the job.

Again, I have only been able to touch lightly on some of the problems facing our agricultural research and development institution. This should be an interesting set of hearings, because these issues are critical to our survival as a Nation and for us to play our proper role in helping the developed and developing countries, in meeting their own food needs.

The testimony presented over the next 2 days of hearings by the various witnesses should help to bring these problems into focus so that the appropriate congressional action may be taken before it is too late.

I am sorry we don't have members of the minority here. I presume they are expected shortly. We will leave the record open for any of them to make some remarks before the morning's witnesses appear.

[The information follows:]

Mr. SCHEUER. Our first witness will be Dr. T. B. Kinney, Acting Assistant Secretary for Science and Education of the U.S. Department of Agriculture. He is Acting Assistant Secretary in charge of research and education. We would be happy to have you come up and join us and bring any of your staff that you care to have accompany you. If you would introduce them for the record, that would be helpful.

STATEMENTS OF T. B. KINNEY, ACTING ASSISTANT SECRETARY FOR SCIENCE AND EDUCATION, U.S. DEPARTMENT OF AGRICULTURE, ACCOMPANIED BY MARY E. CARTER, ASSOCIATE ADMINISTRATOR, AGRICULTURAL RESEARCH SERVICE, AND CLARE I. HARRIS, DEPUTY ADMINISTRATOR, PLANT SCIENCE, COOPERATIVE STATE RESEARCH SERVICE

Dr. KINNEY. I have with me today Dr. Clare I. Harris on my left, Deputy Adminstrator for Plant Science with the Cooperative State Research Service, and on my right, Dr. Mary E. Carter, Associate Administrator of the Agricultural Research Service.

Mr. SCHEUER. Before you start, may I ask whether those charts over there, which I presume we got from the Department of Agriculture, are they correct?

Dr. KINNEY. The one on the left is correct. The one on the right, I think I have seen similar charts and I think it is accurate.

Mr. SCHEUER. Why don't you address us informally summing up your testimony in 8 or 10 minutes? Your prepared statement, of course, will be printed in full at this point in the record.

Dr. KINNEY. Mr. Chairman, I do have a rather lengthy statement which, as you indicated, is available for the record. I do need to hit what I think are the major points of importance in the testimony.

First of all, I cannot stress enough the vital importance of the cooperative efforts of both the Federal, State, and private research organizations and the interest of the Congress to the total research program. Because of good planning and management, public investment in production-oriented research and extension——

Mr. SCHEUER. May I interrupt you by welcoming our colleague, Dick White of Texas, who is a ranking member of the Armed Services Committee; but I think he comes here as a sophisticated and knowledgeable Texan, very much attuned to the problems of water, and to the need for agricultural research to protect the $10 billion Texas agriculture business over the long run; agriculture is going to be in serious trouble if we don't make some real progress on water shortages, on soil erosion, on decertification and other problems. I am very happy to welcome Congressman White. I am sure he will make a great contribution to this hearing.

Dr. KINNEY. Because of good planning and management, public investments in production-oriented research and extension have provided returns to taxpayers in the range of 30 to 50 percent annually. Our mission-oriented system continues to be responsive to the future needs of U.S. agriculture.

The attention which must be given to some current surpluses should not distort our recognition of long-term research needs.

As you were just saying, Mr. Chairman, natural resource constraints, primarily land and water, coupled with high energy costs

suggest that much of the future increase in food, fiber, and timber production must come from increased efficiency of production rather than from any significant expansion of acreage or water use.

The U.S. Department of Agriculture was established as the lead agency in the Federal Government for the food and agricultural sciences in section 1403 of the Food and Agriculture Act of 1977. As such, it is a primary performer of agricultural and forestry research and bears the lead responsibility for the coordination of all such research supported by Federal funds.

As requested by the committee, my statement will confine itself primarily to ARS and CSRS, which represent a large component of the publicly supported agricultural research system in the United States.

The Agricultural Research Service is the U.S. Department of Agriculture's principal intramural research agency. The mission of ARS is to plan, develop, implement, and evaluate research that is designed to produce the new knowledge and technologies necessary to assure the continuing vitality of the Nation's food and agricultural enterprise. As a Federal research agency, ARS (1) addresses problems that are of national concern, (2) conducts research and development that are appropriate for the Federal Government, and (3) exploits the unique capabilities of ARS scientists and the facilities in which they work.

ARS now has the responsibility for the higher education activities of the Department.

ARS has scientific capabilities comprised of more than 2,700 scientists and engineers plus support staff with the knowledge, technical expertise, and specialized scientific equipment to respond to broad regional and national problems. ARS operates unique facilities and laboratories which provide essentially all the disciplines demanded by agricultural research. Many of the facilities are highly specialized.

ARS has an organization capacity to assemble resources including central management that can muster interdisciplinary teams to address broad geographic problems, research needs of action agencies and other Federal organizations, and other high-priority needs for knowledge and technology. ARS has institutional arrangements for working with State agricultural experiment stations, industrial research institutions, and others to bring their talents and resources to bear on problem solving.

ARS and the State agricultural experiment stations have a long history of close working relations. Many ARS scientists and groups of scientists are located on or near university campuses associated with an SAES. The interactions and exchanges by individual scientists at this level have been numerous and productive. The regional research program of the SAES involves cooperative projects in which two or more States jointly address a common problem.

The State agricultural experiment stations employ more than 12,000 scientists with research assignments equivalent to approximately 6,500 scientist years. There are SAES programs in every State, the District of Columbia, and in several territories. In most cases, the SAES are a part of a land-grant university and intimately associated with programs of higher education and extension. On

the average, Federal funds from CSRS Hatch Act formula funds account for less than 20 percent of the total support to the SAES. State appropriations provide about 60 percent of their support with the balance coming from other CSRS accounts, other Federal agencies, industry, and private foundations. The programs of the SAES are comprehensive and include strong efforts in the full range of disciplines that support agriculture.

The program direction of an individual SAES is primarily determined by the needs of the State. However, the SAES are well organized regionally for cooperation and sharing in meeting program needs. The SAES also take advantage of their well-developed organization and mechanisms to help address national problems.

The cooperative programs of CSRS address several research areas. The programs with the 1890 institutions through Evans-Allen funding address a wide range of subjects but the special needs of limited resource farmers and rural people have been emphasized. There are research programs conducted by 1890 institutions in 16 States with a total of approximately 220 scientist years of effort. The cooperative animal health programs with the colleges of veterinary medicine are aimed at diseases of livestock and poultry which are important to commercial agriculture. The cooperative forestry research program [McIntire-Stennis funding] provides a comprehensive program of forestry research through a network of State university forestry research organizations that includes some 800 faculty scientists.

A CSRS program of competitive research grants for basic research was first funded in 1978 at a level of $15 million and has only grown to a funding level of $16.3 million in 1982. This important program's relatively unchanged funding level has meant a significant decline in real terms which the fiscal year 1983 budget proposes to change.

The capacity of the Agricultural Research Service and the cooperative State research service to make major contributions to a sustainable U.S. agriculture is fundamentally sound. Ongoing programs and facilities are available to address long-term needs consistent with the emerging biological revolution. Many of our scientists are in the forefront of cellular level research.

The long-term agricultural research goals articulated in the 1966 study sponsored by the Association of State Universities and Land Grant Colleges and the USDA were reported in the 1975 Science and Technology hearing. These comprehensive goals reflect the direction of agriculture research and are fundamentally sound and consistent with our research capacity. However, major changes have occurred in the emphasis placed on individual goals. The Joint Council on Food and Agricultural Sciences has recently updated this goal structure to encompass research, extension and higher education. This comprehensive national program structure provides a framework for policy analysis and is being used by the Joint Council and the User's Advisory Board. The Department uses this same structure to review program and budget issues.

In December 1981, the Agricultural Research Service initiated a strategic planning process to target the minimum number of research approaches necessary to achieve the mission and goal.

The ARS strategic plan is a framework for selecting and planning research. It is also a framework for evaluating progress and for coordinating the efforts within ARS with other research organizations, with action agencies n USDA, and with the users of our research.

ARS is now developing an implementation strategy and is adjusting its existing operational plan so that managers will address our resources to accomplishing the objectives and thereby the ARS goal. Reassigning of priorities, reassessing of resources, and reshaping policy guidelines will be a continuous process to assure that an effective operational plan is in force at all times.

Since the 1975 hearings by this committee, the Congress has provided major institutional mechanisms through title XIV of the Food and Agricultural Act of 1977 and the Agriculture and Food Act of 1981 to assist us in national research planning and coordination. Key mechanisms include the following: Established an additional position of Assistant Secretary of Agriculture; established the Joint Council on Food and Agricultural Sciences; established the National Agricultural Research and Extension Users Advisory Board; Subcommittee on Food, Agricultural, and Forestry Research; the Secretary's reports, each January.

These mechanisms, as established by Congress, have provided us with an expanded framework for national planning, coordination and congressional oversight. Our decentralized agricultural science system has been successful because scientists and science managers have worked cooperatively and with flexibility in addressing agricultural science needs and opportunities.

Management and review mechanisms are in place to evaluate and coordinate ARS and SAES programs consistent with current and long-term needs. ARS holds program reviews with participation involving ARS, SAES and industry to assess the direction and quality of the research programs. Our scientists are evaluated by peers and promoted on the basis of excellence and productivity. The SAES working with CSRS conduct reviews of their programs with ARS, industry, and other university personnel participating. These reviews make an important contribution to the exchange of views, minimize duplication, foster excellence and help keep managers alert to current and impending problems.

The fundamental mechanisms to support national science policy reviews are well established by title XIV of the 1977 Act and congressional oversight. We have internal management processes that facilitate coordination at the State and National levels. Our system now possesses considerable organizational flexibility to respond to changing priorities, a characteristic that must be preserved. Some organizational refinements may be needed within our recent organizational structures. Expanding scientific excellence continues to be a prime management objective and we must assure the availability of trained scientists to sustain future scientific progress. The management of the scientific resources available to us will continue to be a major challenge in carrying out the mission and goals of the U.S. Department of Agriculture.

Mr. Chairman, this concludes my prepared statement. We will be happy to respond to any questions you may have.

[The prepared statement of T. B. Kinney follows:]

STATEMENT OF

DR. TERRY B. KINNEY, JR.

ACTING ASSISTANT SECRETARY

SCIENCE AND EDUCATION

U.S. DEPARTMENT OF AGRICULTURE

before the

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

of the

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

July 27, 1982

Mr. Chairman and Members of the Subcommittee, it is a pleasure to appear before you today to discuss with the Committee the challenges facing agriculture research in the coming years and the U.S. Department of Agriculture's capacity along with the State and private research system to meet long-term research needs. I am accompanied by Dr. Mary E. Carter, Associate Administrator of the Agricultural Research Service and Dr. Clare I. Harris, Deputy Administrator, Plant Science, Cooperative State Research Service.

Mr. Chairman, I cannot stress enough the vital importance of the cooperative efforts of the Federal, State, and private research organizations and the interest of the Congress to the total research program. The National oversight of agricultural science and technology resulting from this type of hearing contributes to planning, program assessments and adjustments that have made our system successful over the years. In examining issues addressed in the 1975 hearings, it is significant to note legislative and programmatic actions that have occurred since that time. Because of good planning and management, public investments in production-oriented research and extension have provided returns to taxpayers in the range of 30 to 50 percent annually. Our mission-oriented system continues to be responsive to the future needs of U.S. agriculture.

The long term demand for U.S. food and agricultural products will continue to expand due to population growth, economic development, and the need to improve diets for much of the world's population. The attention which must be given to some current surpluses should not distort our recognition of long-term

research needs. Natural resource constraints, primarily land and water, coupled with high energy costs suggest that much of the future increase in food, fiber, and timber production must come from increased efficiency of production rather than from any significant expansion of acreage or water use. We are losing about two billion tons of topsoil annually, and nearly three million acres of agricultural lands are lost yearly to non-agricultural uses. Our water supply for agricultural use is diminishing at a time when water is one of the most limiting resources in crop production. To maintain export levels we must conserve our productive base.

Issues of improved productivity and natural resource conservation are major concerns. At the same time issues of human nutrition, consumer and worker safety, and environmental quality cannot be ignored. In addition, we must strive to balance these issues with available resources in a time of economic uncertainty and requirements for fiscal restraint.

THE ROLE AND CAPACITY OF ARS, FS, AND CSRS TO CONDUCT THE RESEARCH NECESSARY TO RESOLVE LONG-TERM AGRICULTURAL PRODUCTIVITY PROBLEMS

The U.S. Department of Agriculture was established as the lead agency in the Federal Government for the food and agricultural sciences in Section 1403 of the Food and Agriculture Act of 1977. As such, it is a primary performer of agricultural and forestry research and bears the lead responsibility for the coordination of all such research supported by Federal funds.

The research program of the U.S. Department of Agriculture is carried out through three agencies with in-house programs and staffs and one agency working cooperatively with State agricultural experiment stations and other state University and private research organizations. The Economic Research Service focuses on economic research. The Forest Service conducts research to achieve improved land management techniques and increased utilization of forests and rangeland resources. The Agricultural Research Service (ARS) operates a comprehensive in-house program of biological and physical science research, and the Cooperative State Research Service (CSRS) administers Federal funds for agricultural and forestry research predominantly at cooperating State University research organizations.

As requested by the Committee, my statement will confine itself primarily to ARS and CSRS, which represent a large component of the publicly supported agricultural research system in the United States.

The Agricultural Research Service is the U.S. Department of Agriculture's principal intramural research agency. The mission of ARS is to plan, develop, implement, and evaluate research that is designed to produce the new knowledge and technologies necessary to assure the continuing vitality of the Nation's food and agricultural enterprise. As a Federal research agency, ARS (1) addresses problems that are of national concern, (2) conducts research and development that are appropriate for the Federal government, and (3) exploits the unique capabilities of ARS scientists and the facilities in which they work—a combination that forms an integrated and coordinated national resource that is not duplicated by others in the U.S. agricultural research community.

Mr. Chairman, let me briefly mention at this point that ARS now has the responsibility for the Higher Education activities of the Department. We will continue our emphasis on strengthening formal education and training programs in the food and agricultural sciences in an effort to assure that the human resources so essential to the research necessary to sustain our food, fiber, and forestry production systems are available in the future.

ARS has scientific capabilities comprised of more than 2,700 scientists and engineers plus support staff with the knowledge, technical expertise, and specialized scientific equipment to respond to broad regional and national problems. ARS operates unique facilities and laboratories which provide essentially all the disciplines demanded by agricultural research. Many of the facilities are highly specialized. For example, we operate laboratories for the study of exotic diseases of plants and animals. Facilities are located strategically across the major farm and rangeland ecosystems and climatic zones of the United States and eight foreign countries. The agricultural research center at Beltsville, Maryland, is the world's largest center and is recognized both here and abroad as an excellent multidisciplinary research facility.

ARS has an organizational capacity to assemble resources including central management that can muster interdisciplinary teams to address broad geographic problems, research needs of action agencies and other Federal organizations, and other high-priority needs for knowledge and technology. ARS has institutional arrangements for working with State agricultural experiment stations, industrial research institutions, and others to bring their talents and resources to bear on problem solving.

ARS also maintains international activities to utilize the talents of foreign scientists and laboratories. Unique germplasm collections and repositories of species of agricultural importance are managed by ARS including world collections of most of the major crop plants, clonal repositories, disease-free seed stocks, collection of microbes and insects, and unique herds and flocks of animals. These ARS collections are shared with the State Agricultural Experiment Stations and others in carrying out cooperative programs.

ARS and the State agricultural experiment stations (SAES) have a long history of close working relations. Many ARS scientists and groups of scientists are located on or near university campuses associated with an SAES. The interactions and exchanges by individual scientists at this level have been numerous and productive. The regional research program of the SAES involves cooperative projects in which two or more States jointly address a common problem. There are approximately 200 such projects and ARS is an active participant in more than 60 of them. These joint projects take full advantage of the particular expertise and facilities of the various participants for a coordinated, combined approach to particular problems. Through regular interactions and joint planning at the administrative level, various States and ARS often reach mutual understanding for a particular SAES or the ARS to assume responsibility for specific research needs.

The State agricultural experiment stations employ more than 12,000 scientists with research assignments equivalent to approximately 6,500 scientist years. There are SAES programs in every State, the District of Columbia, and in

11-864 O - 83 - 2

several territories. In most cases, the SAES are a part of a Land-Grant University and intimately associated with programs of higher education and extension. On the average, Federal funds from CSRS Hatch Act formula funds account for less than 20 percent of the total support to the SAES. State appropriations provide about 60 percent of their support with the balance coming from other CSRS accounts, other Federal agencies, industry, and private foundations. The programs of the SAES are comprehensive and include strong efforts in the full range of disciplines that support agriculture.

The program direction of an individual SAES is primarily determined by the needs of the State. However, the SAES are well organized regionally for cooperation and sharing in meeting program needs. In some cases, one SAES will assume the total research responsibility in a problem area for two or more States; or there may be agreement that ARS will meet that responsibility. The SAES also take advantage of their well-developed organization and mechanisms to help address national problems. A current example of effort on a national problem is the National Atmospheric Deposition Program which was developed through an SAES regional project to involve more than 20 SAES and numerous Federal agencies in a program addressing acid deposition. Basic research is an important component of the SAES program and it is estimated that 37 percent of the SAES program is basic research. A strong involvement of the SAES in graduate student training activities has insured an influx of new ideas to their research programs and at the same time has provided training for new scientists.

The cooperative programs of CSRS address several research areas. The programs with the 1890 institutions through Evans-Allen funding address a wide

range of subjects but the special needs of limited resource farmers and rural people have been emphasized. There are research programs conducted by 1890 institutions in 16 States with a total of approximately 220 scientist years of effort. The cooperative animal health programs with the colleges of veterinary medicine are aimed at diseases of livestock and poultry which are important to commerical agriculture. The cooperative forestry research program (McIntire-Stennis funding) provides a comprehensive program of forestry research through a network of State University forestry research organizations that includes some 800 faculty scientists. CSRS, Forest Service, and the participating institutions interact constructively on the planning, coordination, and conduct of forestry research. Since 1976, over 60 forestry schools, CSRS, and FS have jointly planned a National Program of Research for Forests and Associated Rangelands. Research can do for forest rangelands what has been done so successfully for cropland agriculture. In many States, the animal health and forestry research programs are part of the SAES.

A CSRS program of competitive research grants for basic research was first funded in 1978 at a level of $15 million and has only grown to a funding level of $16.3 million in 1982. This important program's relatively unchanged funding level has meant a significant decline in real terms which the fiscal year 1983 budget proposes to change. The program is addressing basic areas of plant science and human nutrition. All colleges, universities and research organizations are eligible to participate in the competitive grants research programs and projects are funded on the basis of peer review evaluations of proposals formally submitted.

The capacity of the Agricultural Research Service and the Cooperative State Research Service to make major contributions to a sustainable U.S. agriculture is fundamentally sound. Ongoing programs and facilities are available to address long-term needs consistent with the emerging biological revolution. Many of our scientists are in the forefront of cellular level research. The first successful vaccine against the deadly cattle virus that causes foot and mouth disease has been developed through genetic engineering techniques. Also the transfer of genetically desirable traits from one plant to another has been demonstrated.

Significant scientific opportunities await development including; diverting more of a plant's energy into seeds rather than foliage; delaying final ripening of wheat and soybeans to increase yields; controlling protein and fat development in animals; understanding the genetic basis of pest resistance; understanding the interaction of external human diet factors and gene expression; and fundamental science to support the control of gene transfer and gene expression in organisms of agricultural importance.

NATIONAL RESEARCH GOALS AND MECHANISMS TO MEET THEM

The long-term agricultural research goals articulated in the 1966 study sponsored by the Association of State Universities and Land Grant Colleges and the USDA were reported in the 1975 Science and Technology hearing. These comprehensive goals reflect the direction of agriculture research and are

fundamentally sound and consistent with our research capacity. However, major changes have occurred in the emphasis placed on individual goals. The Joint Council on Food and Agricultural Sciences has recently updated this goal structure to encompass research, extension and higher education. This comprehensive common National program structure provides a framework for policy analysis and is being used by the Joint Council and the User's Advisory Board. The Department uses this structure to review program and budget issues.

In December 1981, the Agricultural Research Service initiated a strategic planning process to target the minimum number of research approaches necessary to achieve the mission and goal. These approaches are embodied in six objectives, by developing the means to:

- manage and conserve the Nation's soil and water resources for a stable and productive agriculture;
- maintain and increase the productivity and quality of crop plants;
- increase the productivity of animals and the quality of animal products;
- improve the system for the delivery and conversion of raw agricultural commodities into food and useful products for domestic consumption and export;
- promote optimum human health and performance through improved nutrition; and

- o integrate scientific knowledge on agricultural production and processing into systems that optimize resource management and facilitate transfer of technology to end users.

The ARS Strategic Plan is a framework for selecting and planning research. It is also a framework for evaluating progress and for coordinating the efforts within ARS with other research organizations, with action agencies in USDA, and with the users of our research.

ARS is now developing an Implementation Strategy and is adjusting its existing Operational Plan so that managers will address our resources to accomplishing the objectives and thereby the ARS goal. Reassigning of priorities, reassessing of resources, and reshaping policy guidelines will be a continuous process to assure that an effective Operational Plan is in force at all times. These planning activities build upon the science needs and ARS role as developed through the debate of science policy issues in the system.

Since the 1975 hearings by this committee, the Congress has provided major institutional mechanisms through Title XIV of the Food and Agriculture Act of 1977 and the Agriculture and Food Act of 1981 to assist us in national research planning and coordination. Key mechanisms include the following:

- o Established an additional position of Assistant Secretary of Agriculture - The assignment is to coordinate all agricultural research, extension and teaching activity conducted or financed by the U.S. Department of Agriculture in carrying out the lead role in food and agricultural sciences.

- Established the Joint Council on Food and Agricultural Sciences - The primary responsibility of the Council is to foster coordination of the agricultural research, extension and teaching activities of the Federal Government, the States, colleges and universities, and other public and private institutions and persons involved in conducting food and agricultural sciences. Key reports of the committee include recommendations on priorities each June, program accomplishments and future expectations of these programs in November and a 5-year plan for food and agricultural sciences updated every two years.

- Established the National Agricultural Research and Extension Users Advisory Board - The Advisory Board has the general responsibility for preparing independent advisory opinions from the point of view of food and agriculture science users. Two key reports are prepared annually. The February report assesses the current Executive budget and the July report identifies policy and program issues.

- Subcommittee on Food, Agricultural, and Forestry Research - This committee of the Federal Coordination Council for Science, Engineering and Technology (FCCSET) reviews Federal research and development and recommends policies, promotes planning, coordination and other measures concerning food and renewable resource sciences.

- The Secretary's reports - Each January the Secretary submits a report to Congress that includes an inventory of programs and recommendations

from the Joint Council. In January 1984, the Secretary will submit a national needs assessment for food, fiber and forest products as mandated by the Agriculture and Food Act of 1981.

These mechanisms, as established by Congress, have provided us with an expanded frame-work for National planning, coordination and Congressional oversight. Our decentralized agricultural science system has been successful because scientists and science managers have worked cooperatively and with flexibility in addressing agricultural science needs and opportunities. The National dialogue on science policy issues carried on systematically through the annual State and Federal legislative processes and advisory committees provides the policy direction that managers and scientists can translate into meaningful and responsive research programs. In recent years a large number of National conferences, significant reports by the National Academy of Science, Office of Technology Assessment, General Accounting Office and Congressional Oversight Hearings have contributed to the productive debate of National policy issues.

Management and review mechanisms are in place to evaluate and coordinate ARS and SAES programs consistent with current and long-term needs. ARS holds program reviews with participation involving ARS, SAES and industry to assess the direction and quality of the research programs. Our scientists are evaluated by peers and promoted on the basis of excellence and productivity. The SAES working with CSRS conduct reviews of their programs with ARS, industry, and other university personnel participating. These reviews make an important contribution to the exchange of views, minimize duplication, foster excellence and help keep managers alert to current and impending problems.

The fundamental mechanisms to support national science policy reviews are well established by Title XIV of the 1977 Act and Congressional oversight. We have internal management processes that facilitate coordination at the state and national levels. Our system now possesses considerable organizational flexibility to respond to changing priorities, a characteristic that must be preserved. Some organizational refinements may be needed within our present organizational structures. Expanding scientific excellence continues to be a prime management objective and we must assure the availability of trained scientists to sustain future scientific progress. The management of the scientific resources available to us will continue to be a major challenge in carrying out the mission and goals of the U.S. Department of Agriculture.

Mr. Chairman, this concludes my prepared statement. We will be happy to respond to any questions you may have.

Mr. SCHEUER. We've had a momentary appearance by Congressman James Sensenbrenner of Wisconsin. We hope he comes back to join us.

Congressman White of Texas, do you want to ask any questions?

Mr. WHITE. No questions, Mr. Chairman.

Mr. SCHEUER. Thank you very much for your testimony, Dr. Kinney. On that organization chart, I take it that is an accurate organization chart for the U.S. Department of Agriculture research and development activities?

Dr. KINNEY. That is accurate so far as the science and education component is concerned.

Mr. SCHEUER. Where in that organization chart, lies the responsibility for formulating long-term national policy on agricultural development, for establishing mission and priorities, and for assigning functions to the whole range of agricultural research and development? Is there any place for these activities on that chart?

Dr. KINNEY. Mr. Chairman, I think it is not possible for all of the planning and long-range or short-range planning to take place at any specific point on that chart. I think the leadership role must come from the Assistant Secretary for Science and Education; however, as you well know, there are many, many people who have a knowledge and should have input into that planning, including all of our State cooperators, and I think the Congress, industry, those outside the system.

In other words, anyone who is familiar with the agricultural research problems should have an input so that there cannot be an autonomous development of a plan.

Mr. SCHEUER. I don't quite understand that answer. What is the mechanism by which these inputs to achieve a long-term integrated agricultural research policy are arrived at? If it isn't on the chart, how does it happen?

Dr. KINNEY. I think what I have been describing, Mr. Chairman, are the inputs that must be considered in arriving at such a plan.

Mr. SCHEUER. We understand that there are a lot of inputs that must be considered. What I am asking you is how does it happen? Where is the structure for the systematic encouragement of these inputs on your chart? Or if it is not on the chart, what is that structure?

Dr. KINNEY. I think, Mr. Chairman, it is implied on the chart with the block, Assistant Secretary for Science and Education. Because we do have in place and have had for a number of years a regional and national planning mechanism, we also have since the——

Mr. SCHEUER. What is that? Where is it located?

Dr. KINNEY. I can have Dr. Harris describe that.

Mr. SCHEUER. My point is you have had three reports in the last year from very competent people. The OTA, the CRS, and the GAO. I read a quote or two from each of them. Your testimony, except for one very brief reference on page 13, ignores the existence of these very thoughtful, indepth scrutinies of our national agricultural research capability. It is as if these reports never took place. The only reference to them is on page 13 where you said in the middle:

In recent years, a large number of national conferences, significant reports by the National Academy of Science, the Office of Technology Assessment, the General Accounting Office, and congressional oversight hearings have contributed to the productive debate of national policy issues.

There has been a productive debate. These three reports have raised very serious questions about our whole national agricultural and research effort, including the lack of long-term policy formulation, the lack of priority setting, the lack of some kind of systematic allocation of research resources. Has your Department addressed some of these reports? You say they took place and contributed to a productive debate of national policy issues. My next question is, has your Department addressed yourself to these reports and if you have, what have you thought about it, what conclusions have you come to, and what have you done about it or what are your plans for doing something about it?

There seems to be a real consensus among these groups expressed perfectly clearly in these three reports that there are very severe deficits in our national agricultural research policy; and we would like to know how you addressed yourself to the questions these three reports inter alia have raised?

Dr. KINNEY. Mr. Chairman, the cooperators in the National Agricultural Research System are very much aware and very sensitive about the reports that have come out. Through the National Planning Committees, through the National Agriculture Research Committee through the Joint Council, through the users Advisory Board and within the agencies affected—for example, I cited the strategy planning going on in ARS—these are all attempts to address, first of all—to determine the extent to which the OTA, GAO, and other reports are accurate; and second, insofar as necessary and possible, to respond to those. I think you will find, Mr. Chairman, there has been some real honest assessment of those reports and there is some action underway to specifically address the concerns of these groups.

Mr. SCHEUER. Can you give us an assessment of these reports?

Dr. KINNEY. As I said in my testimony, it is my opinion that the system of agricultural research in the United States is not in dire straits.

It is a good system, it has been functional for more than a century, and I think we do need to respond to some of the adjustments that must take place; but we cannot in my opinion from the Department of Agriculture in Washington dictate what the priorities must be because many of the actors in the system, many of the essential actors are State university, private organizations, and so forth that have priorities that are not necessarily national in scope.

So it is a very difficult problem to address, but it is the intent of the Department to address them.

Mr. SCHEUER. You have had these reports for a year now; some more than a year, some less than a year. How is the Department addressing the problems raised in these reports?

Dr. KINNEY. How is the Department addressing it?

Mr. SCHEUER. How are you addressing it?

Dr. KINNEY. The Department is addressing it within the system available to the Department for planning for assessment; and as I

indicated before, the Regional Planning Committee, the National Planning Committees, the Joint Council, the UAB, the Agricultural Research Service and others are being looked to for the assessment that will be brought together at the Department level.

Mr. SCHEUER. Can you give me some kind of indication of which of these entities is examining these reports and when they will have some kind of an assessment for you? Isn't your own office making any assessment of these reports? Aren't you doing any in-depth creative thinking about the meaning of these reports to our national agricultural research effort and the role that your Department should be playing? Haven't you done something along these lines?

Dr. KINNEY. Yes; we have, very much so.

Mr. SCHEUER. Could you give us the result of your thinking?

Dr. KINNEY. I can give you an example of the sort of response that has taken place, and I think the one I cited with the Agricultural Research Service is a good example.

The strategic plans that we have been working on, ARS has been working on since December, have involved more than 500 scientists in ARS, with a national hookup so that they could rapidly exchange information, develop priorities, both short- and long-range, develop the technology, or descriptions of technology that is going to be necessary.

This has also involved very close communications between the State colleges and with industry colleagues. The followup development of the implementation plan will involve as many or more people.

So I think this is an example of the response that one agency has made.

The Agricultural Research Service and our State colleges have made other similar responses. As I said before, I do not think in a short period of a year or year and a half when these reports have been going out that it is possible to bring together at the Department level a group of people that are going to revolutionize the total planning and priority setting system for the country, but I can say that we are moving very positively toward addressing the concern of groups such as OTA.

Perhaps my colleagues, Dr. Harris and Dr. Carter, would care to comment further.

Dr. HARRIS. I would like to go back just a minute to review. You asked about the formal structure. We have to deal with these kinds of questions. At the 1975 hearings there was a detailed presentation on the mechanism by which the States and the USDA came together to formally establish committees that dealt with planning and cooperation for agricultural research—at that time it was through the Agricultural Research Policy Advisory Committee.

Title XIV of the 1977 Food and Agricultural Act clearly established the intent of the Congress that this kind of planning structure should be continued and handled through the Joint Council on Food and Agricultural Sciences. The current Joint Council is co-chaired by Dr. Kinney along with a representative from the State institutions, and is the formal structure through which the regional and national planning system operates. As Dr. Kinney pointed out, ARS has taken very specific steps to come up with a strategic

plan for their program, and the Joint Council structure is considering this as it looks at planning for the total system.

We have to recognize that we have a very large contribution of State-funded organizations, private-funded organizations, for which it would not be appropriate for the Federal system to dictate exactly how they should carry out their work.

On the other hand, there is a very definite interest and desire on the part of these participants to share and work together and take advantage of the planning done by ARS, and come together with a broad plan that will meld all of the needs of the participants.

A formal step that is being taken—this again was directed by the Congress—is a needs assessment for agricultural research that will take advantage of the work that is done in ARS and all the participants, as a first step for a more comprehensive approach to planning and defining what the needs are.

Mr. SCHEUER. Is there anyplace at a comparatively high level in the Department of Agriculture where an assessment is taking place on these three reports, at the least, and perhaps some of the others, a GAO report, the CRS report, and the OTA report?

Is there anyplace where these reports are being reviewed and appraised and perhaps some nuggets drawn from them that would help the Department of Agriculture play a more useful, more productive leadership role in creating some long-term planning mechanism?

Nobody is talking about revolutionizing American agricultural research, Dr. Kinney; there has been a persistent and continuing drumbeat of criticism of our Department of Agriculture and of our research and development schema—all of the elements in the private sector and universities and the Government—for not engaging in more constructive, thoughtful, and imaginative long-term planning to meet our own long-term agricultural and food and nutrition needs, not to mention those of the developing world.

Dr. KINNEY. Mr. Chairman——

Mr. SCHEUER. I am trying to find out if people at the top level of the Department of Agriculture are thinking seriously about these three reports and other reports where there is quite a consensus that you are not doing the job that could be done. It seems you do have a problem of funding because if you look at the funding you have had over the last 4 or 5 years, it is going up to a very minor extent, and if you cranked into the computer the effect of inflation in real dollars, you have had a significant drop in agricultural research funding.

So you need more in the way of resources. But I think before you are going to convince the executive branch and the Office of Management and Budget as well as the Congress that you need more funding, you are going to have to show that some thoughtful consideration has taken place of where we are in our agricultural research programs, including the new mission of the Department—to plan for agricultural research needs over the long term, and to establish priorities, to establish missions.

I think you would have to prove to the Administration and the Congress that you are prepared to use more moneys efficiently, productively, and creatively.

Now, is this consideration going on anywhere in your office or at a top level in the Department of Agriculture?

What has been your response to the three reports, among others?

Dr. KINNEY. Mr. Chairman, the lead responsibility for responding to any Congressional, GAO, or other report rests with the Office of the Assistant Secretary for Science and Education and to my knowledge, the GAO and OTA reports have been responded to and we can provide for the record the response that came from the Department.

That is a formal written response.

Mr. SCHEUER. We would like those and we will hold the record open if you will submit those.

[The information follows:]

GAO FINAL REPORT CED-81-141, DATED JULY 24, 1981, ENTITLED "LONG-RANGE PLANNING CAN IMPROVE THE EFFICIENCY OF AGRICULTURAL RESEARCH AND DEVELOPMENT"

RECOMMENDATION

We recommend that the Secretary of Agriculture develop an agencywide long-range plan for agricultural research and development.

ACTION

The Department recognizes that one of the ways to maintain and improve agricultural research and development is through exploration, adoption, and adaptation of the latest management practices, including long-range planning techniques. As noted in the report, the Department has developed long-range planning documents for research. In addition, two events which have significant implications for achieving what we believe to be the intent and purpose of the GAO findings and recommendations occurred in July, virtually simultaneously with the publication of the report and were, therefore, not included in that analysis. The first was the adoption by the Joint Council on Food and Agricultural Sciences on July 16, 1981, of a unified common program structure for the food and agricultural sciences. This was part of an ongoing Joint Council effort dating back to late 1979. A final report on the subject is expected for the October 1981 meeting of the Joint Council. The second was the implementation by the Director, Science and Education, of operating guidelines for science and education in a memorandum to all employees dated July 27, 1981. GAO was aware of a preliminary draft of these guidelines and noted in the report that they were "by far the most ambitious development for research planning within USDA" and that if adopted, "long-range planning research should be easier to obtain." (sic)

While the report is somewhat vague as to what is meant by long-range planning and what would satisfy the GAO definition of a long-range plan, we are concerned that there may be an over-emphasis on procedure and format versus intent and purpose. The general definition and discussion provided by GAO is admittedly the generally accepted view of long-range planning as first developed and practiced in organizations in private industry which have a hierarchical command and control structure. However, direct application of specific long-range planning systems and procedures from that setting to an intergovernmental, multi-organizational science and education system is questionable. The U.S. agricultural research and development system is not a single organization and models developed in and for the latter are not necessarily the most appropriate and effective ones for the former.

We do concur, however, with the value and benefits of long-range planning, or any other management tool for that matter, that encourages "managers to anticipate future needs and determine how those needs can be satisfied with available resources." The Department has done and will continue long-range planning of research and development. The Department will also continue, as it has in the past, to improve on existing long-range plans and techniques. Certainly, there is room for improvement, as well as significant recent developments, as noted above, to foster those improvements.

The report suggests the value of both the Federal and State agricultural research participants cooperatively identifying future food and agricultural needs and the research alternatives that would assist in filling them. The report also contains in Appendix I GAO proposed revisions to Public Law 95-113 Title XIV that would mandate such an activity. As noted in a letter to the General Accounting Office from the Joint Council on Food and Agricultural Sciences dated July 20, 1981, and reproduced as Appendix IV of the report, the Joint Council has accepted the challenge to lead such an assessment effort. A plan for the scope and method of the assessment as well as how to integrate it into other Joint Council planning and reporting responsibilities is currently being developed for presentation to the Joint Council Executive Committee in mid-September 1981. We also understand that Congressman Brown will be meeting with the Executive Committee during the same period to discuss his views on the assessment and long-range planning. We view these steps as positive and an indication of the seriousness with which the Joint Council is approaching this endeavor.

The report concludes with a recommendation "that the Secretary of Agriculture develop an agencywide long-range plan for agricultural research and development." From earlier language contained in the report, we assume the coverage of such a plan would be limited to in-house research under the direct control of the Department. Given the significant activities that are currently underway or about to begin, and, more importantly, our belief as well as GAO's that "effective national planning can take place only if all involved parties participate in the plan's design" and that "a structured, cooperative effort ...could reduce the tension among the Federal/State research partners," we believe it would be inappropriate and possibly dysfunctional for the Department to unilaterally develop an in-house long-range agricultural research and development plan at this time. Such a plan would also have the serious shortcoming of not encompassing the significant amount of research conducted by our State partners. As opposed to operational planning, this could be a serious defect in attempting to achieve the purposes and benefits of strategic, long-range planning for agricultural research and development.

Early indications suggest that the needs assessment and other planning activities currently being developed and considered by the Joint Council offer a real opportunity to achieve the full intent of the report rather than the more limited recommendations. Consequently, we believe the Joint Council effort should be given every opportunity and encouragement to succeed. We will, of course, monitor the Joint Council's efforts closely and act accordingly. This will be facilitated by the Director of Science and Education who is both the Department's lead policy official to insure long-range planning of research and education and the co-chairman of the Joint Council. We believe this approach is the one that is most likely to lead to successful and effective activities to insure the continued productivity of the agricultural research and development sector in the near and far term.

Response by SEA to Questions From OTA
Relative to their Assessment of U.S. Food & Agricultural Research
SEA: 7-25-80

I. How does USDA perceive its role (vis-a-vis SAES, other Federal agencies, non-land-grant universities, the private sector, etc.) in U.S. agricultural research in production, post-harvest technology, human nutrition, and other major research areas? Are the terms national, regional, and local, or basic, applied, developmental, etc. relevant in determining the role of USDA? Within USDA's role, what is the rationale, scientific or otherwise, for determining what the USDA should do (in-house vs. contract vs. grant vs. formula funding)? In the international research area, how does the Science and Education Administration (SEA) perceive its role related to section 406 of Public Law 89-808?

A. Roles

1. Role of USDA

The USDA conducts basic and applied research essential to the development of knowledge, technology, and understanding necessary to ensure the Nation an adequate supply of high-quality food and fiber, a quality environment, a renewable resource base for energy, and prudent use of land and water resources, and, more specifically, to meet the needs of producer and consumer client groups identified in authorizing legislation. The partnership between science and education agencies in the Department and the State experiment stations and their joint association with industry strengthens mutual capability to respond to food and agricultural needs at local, state, national, and international levels.

The Science and Education Administration (SEA) provides overall coordination, planning, and support for food and agricultural science and education programs. SEA conducts and supports research across the broad range of food and agricultural sciences, including human nutrition. SEA communicates and demonstrates the results of this research to farmers, processors, and consumers, and other user groups. SEA provides expertise in support of the policy and action and regulatory functions of the Department of Agriculture and other government agencies. Other work includes developing and maintaining library and computer information systems to assist the public, researchers, and educators. SEA also responds to international food and agriculture needs through research and education.

(a) The research performed by SEA-Agricultural Research (AR) is authorized by the Department of Agriculture Organic Act of 1862 (5 U.S.C. 511), the Research and Marketing Act of 1946, as amended (7 U.S.C. 427, 427i), and the National Agricultural

11-864 O - 83 - 3

Research, Extension, and Teaching Policy Act of 1977 (P.L. 95-113). SEA-AR's role is to:

- o Maintain and manage a dynamic research organization with a broad base of scientific expertise. The organization has resources and managerial flexibility to address new and changing problems and priorities without geographic or local political constraints.

- o Fulfill the diverse needs of agricultural users from farmers to consumers by focusing resources, facilities and effort on specified problems of national interest or national security and broad regional concern. Areas of emphasis include natural resource conservation, production and protection, processing and distribution, and consumer-related problems such as food safety and quality and human nutrition.

- o Respond to the agriculture-related research needs of Federal action and regulatory agencies, and, when appropriate, conduct independent tests and evaluations in the best interests of the U.S. Government.

- o Interact with and respond to needs of Extension.

- o Provide support and training opportunities for agricultural higher education programs.

- o Participate, as the major Federal in-house research component of SEA, with other sectors of the agricultural research system in planning, coordinating, and executing high-priority national and regional research programs.

- o Provide specific capabilities needed to complement or support research programs of cooperators and partners, and to attack problems important to the Nation which no one State or private group has the resources or need to solve.

- o Conduct research and development to meet international needs as determined by policy of the U.S. Government and the increasingly global nature of agriculture.

- o Carry out research and development programs as required to fulfill the mandates of Congress, the Secretary of Agriculture, and the President.

(b) SEA-Human Nutrition (HN)--SEA-HN conducts basic and applied human nutrition research and associated nutrition information and education programs necessary to assess and improve the nutritional quality of diets. Its role is to:

- o Develop objectives and plans for each of the SEA Nutrition Centers being established cooperatively with participating

universities as part of a national program and plan in human nutrition.

- Support extramural research in human nutrition, with an appropriate balance of in-house, mission-oriented extramural, formula-funded, and the competitive grants programs.

- Develop human nutrition information and education programs, coordinate these programs within the Department, and deliver nutrition information to the public and user groups, in close cooperation with SEA-Extension and SEA-Technical Information Systems.

- Develop effective coordination mechanisms with other agencies concerned with human nutrition within the Department, other Federal agencies, and other institutions.

- Conduct technical clearance of all human nutrition education and information materials developed by the Department.

- Insure that human nutrition programs and policy decisions of the USDA reflect and are consistent with scientific consensus.

(c) SEA-Cooperative Research (CR) has a central role in administering certain Federal funds for State research in agriculture and forestry, and in coordinating the cooperative State-Federal research system for agriculture and forestry. SEA-CR administers certain Acts of Congress that authorize Federal appropriations for agricultural research carried on by the State Agricultural Experiment Stations of the 50 States, Puerto Rico, Guam, the Virgin Islands, and the District of Columbia; by approved schools of forestry; the 1891and-grant institutions and Tuskegee Institute; and other eligible institutions. SEA-CR administers a competitive research grants office which makes research funds available on a competitive basis to both Land-Grant and non-Land-Grant Universities as well as in-house laboratories.

Federal formula funding for research in the States is provided by the Agricultural Experiment Stations Act of 1955 (Hatch Act as amended); the Cooperative Forestry Act of 1962 (McIntire-Stennis); the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (P.L. 95-113) for payments to 1890 Colleges and Tuskegee Institute; the Rural Development Act of 1972 for rural development research; and the Animal Health and Disease Research (P.L. 95-113). Research of interest to two or more states, conducted by participating scientists working within a regional research technical committee, can be supported by Regional Research Funds available under the Hatch Experiment Station Act (P.L. 84-352).

The role of SEA-CR is to:

- o Approve proposed research projects and programs to be funded under the various acts.
- o Coordinate research being done among the various cooperating institutions.
- o Provide liaison between and among the States and Federal agencies on matters relating to agriculture and forestry research.
- o Help the institutions improve their research--through subject matter reviews, and through special reviews that help the institutions plan their research programs.
- o Represent the State research system at the Federal level.
- o Represent the States and the Federal government in various bilateral programs between the U.S. and other countries.

2. Role of SEA in Relation to Other Federal Agencies

SEA plays a major role for the Department in coordinating Science and Education activities with other Federal agencies. This is done through joint planning of specific projects and programs of mutual interest, through interagency committee and special studies, and through jointly planned budget development activities.

(a) Action and Regulatory Agencies. SEA provides research and participates with Federal action and regulatory agencies in implementing their regulatory and programmatic responsibilities. Thirty to 75 percent of the projects in SEA-AR (depending on program area) directly or indirectly support Federal action and regulatory programs; SEA-HN research is important in the support of the Department's Food and Nutrition Service. SEA-AR scientists in the field are assigned to special emergency response teams when called upon by an action/regulatory agency. The success of many regulatory activities is dependent on timely response and redirection of research efforts. Research support and technical assistance is provided to virtually every action/regulatory agency in the Department as well as the Environmental Protection Agency; Tennessee Valley Authority; Department of Interior; National Oceanic and Atmospheric Administration; Department of Energy; Food and Drug Administration; Department of Defense; National Aeronautics & Space Administration; National Institutes of Health; and others.

(b) Sister Science and Education agencies. The Director of SEA in his role as Science & Education officer reporting to the Secretary of Agriculture, facilitates coordination of research

within the Department and with other Science & Education agencies. This includes ESCS, FS, SCS and OICD in the Department, and NIH, FDA, EPA, DOI, NSF, DOE and others outside the Department.

3. Cooperators

Land-Grant and Non-Land-Grant universities, 1890 Schools, Tuskegee Institute, and the Schools of Forestry conduct research on the problems continuously encountered in the development of a permanent and sustaining food, agriculture and forestry, and in the improvement of the economic and social welfare of rural and urban families. Because of differences in climate, soil, market outlets, and other local conditions, each State has distinct problems in the production and marketing of food and fiber crops and products. Farmers, foresters, ranchers, and rural people in the individual States look to their State Agricultural Experiment Stations, universities and colleges for solution of the State and local problems and request services to help meet changing needs. Research programs at State institutions, to be most effective, include participation in regional and national programs. Joint effort by a group of State institutions is often an effective and practical approach to solving regional and interregional problems of mutual interest. Universities conduct basic research and address regional and national problems with funding from a variety of Federal, non-Federal, and other sources.

4. Role of the Private Sector

Many agricultural industries conduct research on agricultural matters to meet their own immediate and long-range needs. In addition, some privately funded agricultural associations as well as several private foundations support agricultural research conducted by the public sector. Industrial research in agriculture is largely concerned with development of new products, new varieties, engineering, and process or machinery improvements. Industrial research and development pertaining to new products and processes is generally aimed at increased profitability and/or patent development or protection. The private sector also devotes significant effort to defensive research in response to regulations. The public sector is generally more concerned with basic and intermediate research and tends to stress high-risk, long-term research which is in the national interest but may not have prospect of immediate economic benefits. Additional attention is needed to the definition of the research roles of the public and private sectors, especially in the area of farm mechanization and post harvest processing. Greater attention is needed to the potential for government-industry-university cooperation.

B. Are ..."national, regional, and local, or basic, applied, developmental, etc."... Factors in Determining USDA Role?

Yes, these are factors that give direction and focus to USDA's role. They are not and cannot be rigid prescriptions or limitations. The USDA role tends to center on basic research on food and agricultural problems that are primarily of national, high priority concern; and on applied or developmental research in support of action and regulatory programs. For example, the CRIS system shows that 43 percent of the total research effort in SEA-AR in FY 1979 is basic research, with about 90 percent of all projects containing some basic. Also, SEA is a regular research provider for about 15 action and regulatory agencies.

The impact of new knowledge or a solution (or lack of it) may be far-reaching. Some national needs, moreover, are aggregations of regional, state or local needs; therefore, the State-Federal partnership is a key ingredient in the USDA role and relationship with cooperators.

The following characterizes the role of a national, centrally planned and coordinated, Federally funded agricultural research organization:

- Responds quickly and effectively to disasters and emergencies by bringing together the necessary expertise.

- Forms, with State agricultural experiment stations, collaborative, synergistic, Federal/State teams with complementary capabilities to research special problems such as moisture stress of plants, nitrogen fixation, photosynthesis, genetic engineering, integrated pest management, and water quality.

- Organizes and conducts, in support of action and regulatory agency programs, long-range research of a national and regional nature, such as soil erosion, sedimentation, and water quality.

C. Rationale for Program Assignment to In-house, Contract, Grant, Formula Funding.

The underlying framework and limits are provided by the language of authorizations--principally P.L. 95-113, Hatch, McIntire-Stennis, and the Rural Development Act of 1972--and by Congressional appropriations. Within this framework, specific guidance originates from decisions on resource allocations to funding mechanisms that are reflected in the annual SEA budget planning and development process. This includes a systematic review of current programs and a careful assessment of needs drawn from internal and external sources. Among the aspects examined for a given program is its appropriateness to the performing units and funding mechanisms. On the basis of this review, recommendations are made, as appropriate, for program redirection, termination, expansion, or adjustments across funding mechanisms. The capability of the in-house research units is

assessed along with that of cooperators and potential use of contracts or grants on a program-by-program basis.

Role-related reasons for recommending that research be done totally or substantially in-house might include that the activity in question: must be done in a manner that is responsive to congressional and legislative mandates; provides direct support of action or regulatory agencies; pertains to exotic diseases, pests, or germplasm, or to unexpected national emergencies; requires unique or high-cost, high-risk facilities or resources; or requires national coordination. Role-related reasons for formula funded research might include that: the problem is of particular importance to a region or group of states; the expertise needed is available in the State system; States have indicated strong willingness to undertake the research; there is a need for research to be done close to the point of technology transfer; the research lends itself to interstate coordination, particularly on a regional basis; or that the research will be enhanced by a broader base of skills, equipment, and facilities available in several states. The grant mechanism is desirable when special emphases or new initiatives and directions in research are needed, or when it is desirable to obtain a broader community of participation than that reached through either formula funding or in-house research only.

Other reasons which might indicate the relative advantage of in-house, formula-funded, or other mechanism include: need for large-scale facilities, availability of appropriate facilities and scientific expertise, need to maintain a viable and flexible Federal-State system, or need for multiple approaches to be undertaken. Contracts work well when specific proposals are needed to be drawn from a broad and highly-specialized base of research capability, to fill a gap or to provide expertise not otherwise obtainable.

D. SEA Role Relative to P.L. 89-808, Sec. 406.

SEA perceives its role related to Section 406 of Public Law 89-808 and international agricultural research as that of the Federal leader in the development of basic scientific information and technology for application to agricultural production and marketing systems in tropical and subtropical regions both in the U.S. and overseas. Section 406 activity is accomplished through an in-house research effort combined with an extramural component which provides opportunities for Federal scientists and State scientists to pool their special skills in tropical and subtropical agricultural research projects in jointly planned activities. The Section 406 program now has two aspects, the Caribbean Basin and Pacific Basin programs. In each case, information and technology acquired through Section 406-supported activity is extended throughout the region.

However, SEA has not been able to capitalize on the additional authority for international activity provided in Section 1458 of P.L.

95-113. This is due to lack of funds and absence of a well-defined role with respect to the AID and Title XII AID-funded university international programs.

II. How are the size and distribution of the USDA food and agricultural research budget determined for USDA in-house, formula funding, grant, and contract research? How does USDA determine priorities for food and agricultural research? What are the roles of consumers, scientists, administrators, OMB, OSTP, Congress, and others in determining priorities?

A. Priorities:

Priorities in SEA are updated each year and used both in shaping the budget request and in planning redirections. Information used in developing priorities is drawn from a very broad spectrum of consumers, producers, in-house scientists and specialists, scientific and technological societies, the Joint Council and Users Advisory Board, action and regulatory agencies, sister S&E agencies, cooperators, policy level people in the Executive Branch, and the Congress. The information drawn from these and other sources, such as special studies, are reviewed and summarized by staff and presented to the SEA Managers who, in close consultation with our university cooperators, set the priorities which guide the upcoming planning year. The greatest impact of these priorities is in shaping the upcoming budget request and agency-wide planning for the upcoming fiscal year.

The following groups had a major impact on shaping the priorities SEA developed for the FY 1982 planning year:

Administration and Congress--The President's science policy statement of 1979, the Domestic Policy Review on Industrial Innovation, dialog between Director of SEA and leadership of the Office of Science and Technology Policy, policy positions taken by the Department and OMB, and Congressional hearings and Committee guidance.

USDA research agencies--A Departmental Science and Education coordination group has been formed to improve coordination of SEA, ESCS, FS, OICD, and SCS programs under the chairmanship of the Director of SEA. A Science and Education overview paper for FY 1982 was developed and presented to the Secretary by the Director of SEA.

Action and regulatory agencies--Consultations include year-round interaction and special consultations early in the budget development process. Areas of common interest are identified. A/R agencies are asked to identify and, where possible, prioritize their needs. SEA staff, working with staff from A/R agencies, seek

consensus themselves on areas to be supported by increases and by redirections and make recommendations to their managers.

Scientists--Some 41 National professional societies were invited in 1979 to indicate priorities. A conference on "Priorities for Agricultural Research, Extension, and Higher Education, held January 27-28, 1980, in Arlington, Virginia, was attended by representatives of 35 societies. The discussion on priorities helped synthesize more than 400 recommendations received. Results are documented in a conference proceedings.

Consumers and producers--In addition to the sources mentioned above, hundreds of specific requests for information and suggestions for research activity are received by SEA each year. SEA officials meet with hundreds of people representing consumers and other users who advise on priority issues.

SEA cooperators--Meetings were held during the FY 82 budget development process with respresentatives of ESCOP, ECOP, RICOP, and the American Association of University Agricultural Administrators. State cooperators are also involved through inputs from IR-6, an interregional planning group established by the State Experimental Station Directors with an office co-located with the Joint Planning and Evaluation Staff of SEA. Aggregations of state research plans and projections, prepared by the Regional Planning Committees and the Interim National Research Planning Committee of the Joint Council, are utilized.

SEA scientists and research managers--Arrangements have been made for in-house scientists to contribute input on priorities and to suggest new approaches. In-house research managers also are valuable sources of priority evaluation and suggestions.

Joint Council on Food and Agricultural Sciences (Joint Council)--Five major reports of the Joint Council contain significant guidance:

"Areas of Emphasis in the Food and Agricultural Sciences of the Early 1980's", March 1980

"1979 Annual Report of the Secretary of Agriculture", March 1980

"Research and Extension and Higher Education in Human Nutrition", March 1980

"Research, Extension and Higher Education for Small Farms", December 1979

"1979-84 Cycle for Projecting and Analyzing Research Program Adjustments with Historical Trends and Comparisons", July 1980

National Agricultural Research and Extension Users Advisory Board (UAB)--Its recommendations are documented in:

"Report of the National Agricultural Research and Extension User Advisory Board", October 1979

"Repor the President and Congress", March 1980

B. Determining Size and Distribution of Research Budget

SEA makes a determined effort to present a balanced research, extension and higher education budget in a program-oriented and integrated annual budget request. The annual budget request builds from a base program assessment with redirection needs considered and set and reflects programs to be given emphasis after careful consideration of current priorities. Once priorities, policies and strategies are set to guide the planning efforts for the upcoming budget cycle, teams of staff scientists, representing the SEA Units involved, develop staff recommendations which are presented to SEA Managers and to representatives of ECOP, ESCOP and RICOP. These recommendations usually include how additional funding would be allocated across SEA Units, and funding mechanisms. Staff recommendations are based on an assesment of current programs, capabilities in SEA Units in each program area, availability of facilities, and legislative authorities and acts. SEA Managers make decisions on resource distributions based on staff recommendations, views of the individual Managers, and, importantly, based on advice of cooperators and advisory groups. For example, SEA Managers meet priodically with representatives from ESCOP, ECOP, RICOP, and AAUAA and discuss program priorities and budget development strategies. This has impact on the agency's final decisions on both priorities, areas of emphasis, and distribution of funds across units and funding mechanisms.

C. Main Steps in Developing SEA's Budget Request

The main steps in SEA's FY 1982 budget development process were as follows:

- Determination of budget process, policies, and strategy for the upcoming budget planning cycle by Managers with significant input from state cooperators.

- Determination of program structure, format, and objectives.

- Determination of areas and level of program emphasis.

- Review of base program by SEA units and compilation of proposals on new research from in-house scientists, specialists, and cooperators.

- Establishment of staff teams to develop budget justification and special analyses with members from involved units in SEA,

generally under the chairmanship of a member of the SEA Program Planning Staff.

- o Review and assessment of staff's recommendations for adjustment of SEA base programs.
- o Development of final budget materials (decision packages and special analyses).
- o Director of SEA makes final decision on budget content and ranking.
- o Agency request is received and modified by the Secretary and his Program Budget Review Board.
- o The Department's budget is reviewed by OMB.
- o Congressional hearings are held and agencies are given the opportunity to testify.
- o Congress appropriates funds.

III. We should like to receive a description and/or organization charts which clearly give the administrative and management responsibilities of SEA, Agricultural Research (AR), Cooperative Research (CR), and Human Nutrition (HN), and how these relate to the technical and planning aspects of research.

A. Administrative and Organizational Responsibilities in SEA. (See Attachment 1.)

B. Once national priorities are determined, how are regional priorities set?

The setting of regional priorities, much like the setting of national priorities, is a dynamic and multi-faceted process. Considerations include studies and recommendations by the Joint Council-sponsored Regional Research Planning Committees and Regional Councils, indications of need from research users, and input from State Experiment Station Directors, SEA-AR Regional Administrators, and private industry representatives. Regional priority-setting by units of SEA is discussed in the following paragraphs.

1. SEA-Agricultural Research: The organization and management of SEA-AR provides for both regional and national perspectives in the establishment and administration of research priorities. A principal, but not exclusive, planning mechanism for linking regional and national priorities is 66 National Programs (NRP) and 9 Special Research Programs (SRP). These link individual research projects in each of the regions to agency and departmental missions, goals, and priorities through

comprehensive national programs of research that cut across all regions and are commodity or problem area in focus. These programs are developed and adjusted through a process that involves a great deal of interaction with the agricultural science community in general and one that draws heavily on the inputs of scientists and administrators in the regions.

The NRP's and SRP's are developed and maintained by the SEA-AR National Program Staff (NPS). Staff scientists on the NPS are responsible for interacting closely with administrators and scientists in the regions to maintain up-to-date programs and priorities, and to insure progress towards the national priorities and objectives outlined in each NRP and SRP. This provides a mechanism to assure that regional priorities are consistent with and reflective of national goals and needs.

Regional Administrators in each of the four SEA-AR regions are responsible for managing the research, facilities, funds, and people within their scope of responsibility. Each Regional Administrator is the accountable official for assuring that research conducted within the region meets the national goals and priorities established in the NRP's and SRP's. Within this mandate Regional Administrators have sufficient managerial flexibility to respond to regional priorities and opportunities.

Opportunities to establish new interdisciplinary and inter-project relationships, work with State scientists, better use facilities, and start a pioneering effort through cost savings in other areas illustrate some of this management flexibility. This flexibility is encouraged as a way of getting the most possible out of available resources. However, the ultimate responsibility of the Regional Administrator is to accomplish the research goals and priorities that his or her region contributes to the accomplishment of national goals and priorities.

2. SEA-Cooperative Research: Food and agricultural research funded by the States and the USDA is a partnership undertaking. Many institutions and agencies are involved in this pluralistic State-USDA system, and there are strong commitments to cooperation and joint planning throughout the system. SEA-CR provides leadership in the identification and planning of regional and national research through participation in the Regional Planning Committee and the Interim National Research Planning Committee established by the Joint Council. The Administrator of SEA-CR participates in meetings of Experiment Station Directors' Associations for the four regions and concurs in areas of research to be implemented. SEA-CR staff

are active in regional technical committees that plan and conduct regional research projects. Projects implemented through the Regional Research Fund Program are approved by the Administrator of SEA-CR.

3. SEA-Human Nutrition: Human Nutrition's research is carried out in five Research Centers and one Consumer Institute. Their programs are national in scope, each with a definite mission, either set by Congressional mandate or by the Department. The plans for implementing the missions of each Center were arrived at through deliberations of planning committees composed of experts from involved USDA agencies, other federal agencies and collaborating institutions.

C. What is the management mechanism by which SEA, AR, CR, and HN are assured that the resources go to the priority problems?

SEA budgets are planned in detail and designed to reflect priorities. Budget requests are modified at various decision points throughout the cycle, such as at the Departmental, OMB, and Congressional levels, based on priorities as viewed by the decisionmakers involved and fiscal constraints to be considered. When Congress appropriates funds, the Director of SEA allocates funds to units in accordance with Congressional earmarking and documented budget plans. Resources are then allocated to the SEA units in accordance with thse documented plans, and usually on a program by program basis. Annual reports of progress on projects (CRIS reports) are submitted and reviewed. Program reviews conducted under the guidance of the planning staffs in SEA provide qualitative as well as quantitative information about progrms and results.

1. SEA-Agricultural Research: SEA-AR uses several interacting mechanisms to assure that resources are dircted to high-priority problems. The activities, implements, and participants utilized are provided in the following table:

Activities & Implements[a]	Participants[b]							
	NPS	PPR	AD/CD	RL	S	RA	ARA	TA
Continuing review of SEA/AR programs organized as National Research Programs and documented by PARIS and CRIS systems, formally by workshops and reviews, and informally by site visits and direct communication.	X	X	X	X	X			X
Annual program evaluation between each of the Regions and organizational segments of NPS (LVS, PHST, etc.).	X	X	X			X	X	
Annual project reviews resulting in WRU Reports and Plans and Resource Management Plans.	X	X	X	X	X	X	X	
Annual Regional program reviews by Regional management and staff utilizing Annual WRU Reports and Plans and Resource Management Plans.		X	X			X	X	
Initiation, renewal, revision, termination of individual CRIS Work Units within the precepts of the Project System.	X	X	X	X	X			X
Annual prioritization of all CRIS Work Units for budget development.	X	X	X			X	X	
Implementation plans that justify and delineate scope, location and level of effort of redirection and new initiatives.	X	X				X		X

[a]Key: National Research Programs - ARS Management and Planning System (MAPS).
PARIS - Program and Resource Information System.
CRIS - Current Research Information System, TM 510-2.
Program Reviews - Policy, Procedures and Responsibility for Documenting and Coordinating AR Program Reviews and Workshops, D-600.6.
WRU Reports and Plans - Work Reporting Unit, Building Block and Financial Project Codes - AM 314.4; Annual Reports and Plans/Position Resource Management - Memo T. W. Edminster, March 13, 1979.
Position Resource Management - AM 408; Annual Reports and Plans/Position Resources Management - Memo T. W. Edminster, March 13, 1979.

[b]Key: NPS - National Program Staff - divided into five segments - LVS (Livestock & Veterinary Sciences, PHST (Post-Harvest Science & Technology), CP (Crop Production), CP (Crop Protection) and SWAS (Soil, Water & Air) and composed of National Research Program Leaders.

PPR - Program Planning & Review Staff (regional)

AD/CD - Area Director/Center Director

RL - Research Leader

S - Scientist

RA - Regional Administrator

ARA - Associate Regional Administrator

TA - Technical Advisors

2. SEA-Cooperative Research: In the case of SEA-CR, the primary management of research programs supported by funds admininstered by SEA-CR is vested in the State Experiment Station Directors, who are charged with responsibility for assigning funds to projects and following through to see they are properly spent. Project proposals for research supported by USDA funds are reviewed and approved by SEA-CR. Annual and special summaries of research effort (funds and scientist years) are provided to SEA-CR staff, enabling them to track employment of resources on national, regional, and state levels. SEA-CR also conducts on-site reviews of participating station programs, where progress is reviewed and future plans are explored. National and regional priorities are an important consideration during all these activities.

3. SEA-Human Nutrition: Implementation of a Research Center's mission is the primary responsibility of the Center Director and his or her Research Leaders. They make use of recommendations from an Executive Committee established for each Research Center, and a Board of Scientific Counselors, who continuously monitor the program. The Executive Committee (which includes representatives of the Center's cooperating institutions) reviews the broad scientific program within the Center, and deals with issues that affect the coordination of the research between participating agencies and institutions and with other aspects of research management. The Board of Scientific Counselors to SEA-HN (presently operating on an ad hoc basis and made up of scientific experts from outside the USDA) reviews the scientific and technical aspects of the program.

   The Administrator's staff, through on-site visits and the analysis of annual reports and plans, monitor the programs, progress and plans of each Center. Their analyses, along with the reports from th Executive Committees, the Board of Scientific Counselors, the Center Directors and Research Leaders, are the basis for the Administrator's selection of priority problems to meet national needs.

D. When new funds for a national or regional priority are available to AR and HN, how are the specific locations for the new or additional work selected, and how are these activities coordinated with SAES?

1. SEA-AR: Preplanning for the use of new funds by SEA-AR is initiated during the budget development process, nearly two years or more prior to Congressional appropriations. While these locations may not be specified in the budget documents, location where new or expanded work would be done is identified at this time. Program reviews (See Attachment 2) which aid in the identification of priority research needs, also provide information for the preliminary selection of locations which

are within appropriate physiographic regions, have the best qualified scientists, and have the best equipped laboratories for implementing research for which increased funding is being requested. If the requested funding is appropriated, NPS and line managers review the current status of personnel and facilities, discuss tentative proposals with appropriate SAES Directors concerning opportunities for productive joint interactions and coordination, and make recommendations to the SEA-AR Administrator on specific location(s) for the new work.

2. SEA-HN: Pre-planning for use of funds is initiated during the budget development process. Representatives from each SEA unit, under the chairmanship of a SEA Program Planning Staff representative, conduct a special analysis of the base program and needs for additional resources in human nutrition-related programs throughout SEA. Based on their analysis of current efforts, needs, and expected results, the team then makes recommendations for increases or decreases in specific programs at selected locations. These analyses and recommendations form the basis for budgetary decisions by the Director of SEA and his management team. Through this process coordination takes place, not only with SAES but also with all units within SEA.

E. What is the relationship of the Program Planning Staff of SEA to the AR National Program Staff (for example, in setting research priorities, allocation of resources, etc.)?

The SEA Program Planning Staff (SEA-PPS) and the SEA-AR National Program Staff (AR-NPS) interact on a continuing basis on SEA matters pertaining to research priorities, program planning and coordination, budget requests, and allocation of funds. The individual responsibilities of the two staffs do, however, differ clearly in carrying out these functions.

The SEA-PPS has primary responsibility for preparation and justification of the SEA budget; for SEA-wide program and resources planning; and for providing staff support in the form of cross-cutting, multi-functional reports, position papers, special analyses, and other assistance as required by the Office of the Director and other SEA managers, and by the Administration and the Congress. SEA-PPS has been providing staff support to the Joint Council on Food and Agricultural Sciences and the National Agricultural Research and Extension Users Advisory Board, established by P.L. 95-113. For the most part, these activities involve programs, priorities and issues of an Agency-wide, cross-cutting, multi-functional nature. In performing these functions, SEA-PPS works with all SEA units (AR, CR, EXT, TIS, etc.) as required, either informally or as team leaders or members.

The AR-NPS serves as the SEA-AR Administrator's principal staff for exercising his authority in managing SEA-AR national research programs. AR-NPS has direct responsibility for the technical

excellence of the SEA-AR program nationally; provides leadership and technical guidance to the SEA-AR scientists; and coordinates NRP and SRP activities to ensure that national goals and objectives are set and met. The staff works with the SEA-PPS in a variety of ways, including furnishing input on the basis of their disciplinary skills, expertise and knowledge of SEA-AR programs to identify needs, budget redirections and increases, and program shifts necessary to achieve SEA-AR and SEA objectives.

Both staffs work with action/regulatory and other science and education agencies in program planning, budget development, and providing technical assistance; with AR-NPS giving emphasis to matters of specific importance to SEA-AR research programs and projects and SEA-PPS emphasizing SEA-wide science and education programs.

SEA managers, not staff, set priorities and decide on resource allocations. AR-NPS provides vital information needed by the SEA-AR Administrator to use in making decisions affecting SEA-AR programs, as does SEA-PPS for the Director and his management team on SEA-wide programs and issues. Cross-cutting teams of staff specialists are often called upon to carry out special studies and assignments and the results are used by SEA and SEA-AR managers in setting priorities and allocating resources.

F. What is the role of the Area Director vs. Regional Administrators vs. the National Program Staff in determining the allocations of funds for regional and national programs, and who has what responsibilities? (Who makes decisions on what scientific disciplines are needed and on the scientists to be hired, promoted, or moved? Who assures that approved programs are carried out and monitors progress?)

SEA-AR's research is conducted at approximately 150 locations in the 50 States, Puerto Rico, the Virgin Islands, and in several foreign countries. Much of the work is conducted in direct cooperation with the State Agricultural Experiment Stations or other State and Federal Agencies, with SEA-AR groups co-located on college campuses

AR-National Program Staff (AR-NPS) and line managers in the regions interact as decisions are made by the managers regarding scientific disciplines needed and personnel matters. They also interact in program review and monitoring. The conceptual basis for this organizational arrangement in SEA-AR and specific examples of its operation are presented in Attachment 3. Policy, procedures and responsibility for documenting and coordinating SEA-AR program reviews and workshops are described in Attachment 2. A detailed statement of functions and responsibilities follows:

1. Administrator: The Administrator of SEA-AR has direct responsibility for the leadership, management, and direction of

the program and activities assigned to SEA-AR. This person provides advice and support to the Director of SEA in formulating national agricultural research policy and in coordinating research activities of the Department. (See Attachment 1)

2. National Program Staff: The Administrator is assisted in these activities by the AR-NPS. Members of this Staff serve as leaders for the National Research Programs of SEA-AR, with direct responsibility for the technical excellence of the program nationally. They function as program development, review, and evaluation staff, concentrating upon ensuring technically sound programs through the proper interaction, balance, and distribution of research effort and focusing upon major national and regional program issues. They serve as the Administrator's principal staff for exercising his authority in managing SEA-AR national research programs. To this end they:

   - Assist the Administrator in establishing SEA-AR policy for program planning, evaluation, budgeting, and coordination with emphasis on national programs, goals, and objectives.

   - Provide technical leadership on a national basis and coordinate research programs in their assigned areas of responsibility.

   - Conduct onsite reviews with scientists and their Regional and Area/Center managers to ensure that specific programs are meeting national goals and objectives.

   - Carry out a national program evaluation and assessment of program balance considering input, objectives, needs, priorities, and plans.

   - Assist the Administrator in the preparation, presentation, and defense of the SEA-AR budget.

   - Provide liaison needed at the national level pertaining to SEA-AR programs with other Federal Departments and agencies, Congress, agribusiness industries, commodity groups, and the public.

   - Determine need for, and plan and conduct, national workshops that provide interaction of research leaders and regional and area managers across regional and area lines in the pursuit of national program objectives.

   - Develop, revise, and maintain the National Research Program structure or SEA-AR.

3. Regional Administrators: Four Regional Administrators, along with the AR-NPS, assist the Administrator of SEA-AR in establishing policy for program planning, evaluation, budgeting, and coordination, with emphasis on matters relating to the assigned region, as well as their relationship to national programs, goals, and objectives. Consistent with national program policies, plans, and objectives, the Regional Administrators:

   - Integrate regional with national program policies and objectives.
   - Coordinate and implement program planning, review, and evaluation within the region.
   - Direct and execute programs within the region.
   - Participate with AR-NPS in planning and conducting onsite reviews.
   - Represent SEA-AR in the planning and execution of activities of the Regional Councils and Research Committees sponsored by the Joint Council for Food and Agricultural Sciences.
   - Provide inputs for budget development.
   - Recommend new and revised research goals and activities.
   - Participate with AR-NPS in approving research plans for individual locations.

4. Area and Major Research Centers: Directors of areas and major research centers:

   - Assist the Regional Administrator in establishing policy for all aspects of program planning,evaluation, budgeting, and coordination for the region.
   - Formulate and recommend area or center policies and objectives for area or center program operations.
   - Coordinate and implement program planning, review, and evaluation within the area or center.
   - Direct and execute programs within the area or center that contribute to SEA-AR and SEA goals and objectives.
   - Participate with AR-NPS, Regional Administrator, and scientists in carrying out onsite reviews.

- Advise the Regional Administrator and AR-NPS concerning the area or center research programs relative to industry, State, and national problems and needs.

- Work with the Regional Administrator and the regional staff in developing information needed by AR-NPS and other headquarters staffs for program planning and evaluation at the national level.

IV. Reference is made to sections 1407 and 1408 of PL 95-113. We should like to have your evaluation of the progress made to date by the Joint Council on Food and Agricultural Research (JC) and by the National Agricultural Research and Extension Users Advisory Board (UAB). Are the JC and UAB fully operative at this time? Are they fulfilling their intended roles? If not, what are the problems that inhibit them from fulfilling their roles? If so, what has been their impact? How do the JC and UAB relate to each other? Are there changes needed in the legislation to make each of them more effective?

A. National Agricultural Research and Extension Users Advisory Board

Operation: The Users Advisory Board (UAB) is fully operative and is fulfilling its basic, legislatively mandated responsibilities to the Department and the Congress. These responsibilities are specifically to make recommendations to the Secretary in October of each year on allocations and funding, and report to the President and Congressional Committees each March its appraisal of the President's budget. The UAB role is evolving through interaction with relevant parties. From the Department's point of view, the UAB, with its 21 members selected according to the guidelines in Section 1408, is satisfactorily broad, balanced, and representative in its membership. Its competence at analyzing concerns and articulating opinions relevant to SEA needs is growing. It has established and is gaining experience with a process for fulfilling its mandated responsiblities to review and assess, a process that includes identification of areas or issues for study and attention, preparation of papers, and informal hearings and site visits to obtain background information on these topics.

In preparation for its October 1979 report to the Secretary of Agriculture, with recommended priorities for funding and allocation of responsibilities for agricultural research and extension programs, the UAB discussed these concerns with representatives of the research and extension organizations involved, and in some cases received written responses (e.g., USDA and Joint Council on Food and Agricultural Sciences). It requested and received an analysis of the President's 1981 budget request for food and agricultural science, organized by the categories used, by the agencies involved, by the priority categories set forth in the UAB's 1979 report, and by those items of priority Congress identified in Title XIV of the 1977 Farm Bill. This work was conducted by SEA staff at UAB direction, and involved Board-staff conferences to ensure that UAB

information needs were met as well as possible. The UAB also reviewed the President's 1980 budget. Public forums were held in St. Paul, Minnesota; Orlando, Florida; and Berkeley, California, to obtain direct views from as many users as possible.

Several aspects of UAB functioning continue to be troublesome: UAB requests for staff analysis and data strain our resources for response. The UAB has yet to deal effectively with identifying negative or low priorities. It needs to be more specific in its recommendations regarding the various performing institutions. These are tasks, however, that no previous user group has ever managed adequately and, because of the UAB's legislative mandate plus its increasing tenacity and aggressiveness, SEA expects it to exceed the performance of past groups. On the whole, the UAB is performing well. Its reports, such as the October 1979 report which identified nine priority areas and described specific issues and needs of each, have been especially helpful.

Problems: UAB members need to learn more about the science and education system and are doing so. The Department and the Congress need to better analyze the information and concerns that underlie UAB positions taken in their reports. The UAB needs to continue to improve its own group decision processes and skills.

Impact: UAB priorities have helped direct SEA budget and program priority setting. The October 1979 report of the UAB identified issues regarding the functioning of State experiment stations and cooperative extension which are receiving thoughtful attention. The UAB is engaged in an iterative dialogue with the Department regarding the 1979 report, which is encouraging continued Department action on UAB priorities. UAB reports are widely read by cooperating institutions, who indicate their agreements and disagreements; thus, UAB often articulates items for discussion for the system as a whole. UAB reports are read by Congressional committees who in turn ask USDA action or comment. Thus, the UAB effectively focuses systemwide dialogue on some important issues.

Legislative changes: SEA does not propose any changes in the legislative authority for the UAB at this time, other than seeking authorization for funding support.

B. Joint Council on Food and Agricultural Sciences

The Joint Council, composed of 25 members representing most components of the food and agriculture science and education community, is fully operative. It meets regularly and deals with a variety of issues facing the science and education system.

The Joint Council was established primarily to foster coordination of the agricultural research, extension, and teaching activities of the Federal government, the States, colleges and universities, and other public and private institutions and persons involved in the food and

agricultural sciences. To accomplish this, the planning and coordination structure shown in the attached diagram (Attachment 4) was adopted. To date, the four Regional Councils have been established and the three National Committees are in the process of being selected and appointed, but these have not yet become active.

The Joint Council aids SEA, the Forest Service, and ESCS by providing a forum for coordinating major agency policy issues with partners who have a stake in the outcome. If the planning and coordination structure functions as expected, coordination of research, extension, and other educational activities should improve significantly.

Problems: The charges given the Joint Council are difficult ones, given the diversity of the institutions making up the system and the decentralized nature of decisionmaking characteristic of the American food and agricultural science and education community. In this environment, planning and coordination take a considerable amount of effort on the part of all the participants. Providing sufficient resources, especially staff support, for Joint Council activities is a problem. The most valuable of these resources, the time and the energy of the members of the Joint Council, has been generously supplied. A great deal of time and effort has been taken in organizing the Council and its associated planning committees, and in attempting to arrive at an effective operating mode. This has cut into the time and energy available to identify and study major issues and promote effective, coordinated attacks on major problems.

Another problem that impedes the Joint Council's effectiveness is the lack of a common program structure cutting across research, extension, and teaching. At present each of these functional areas have their own program structure or structures and management information systems, developed over time and adjusted to needs that were salient during that historical development. These structures are not adequate to enable the Joint Council to examine interrelationships among the research, extension, and teaching functions within a given problem or subject matter area. SEA is cooperating with the Joint Council to develop an overall common program structure that is compatible with existing systems. If successful, this could be a major step toward improving planning and coordination.

Impacts: It is probably too early to assess the full impact of the Joint Council; however, it has already had some influence on the direction programs have taken in several areas.

In 1979 the Joint Council placed major emphasis on improving coordination in human nutrition, integrated pest management, and small farms problems and programs. It appointed an Interim National Research Planning Committee to continue the 5-year research planning cycle while the permanent planning structure was being established. The Council also took action to provide for broad involvement of

public and private interests in development of plans for Renewable Resources Extension programs.

The Council, through subcommittees, prepared a report on the President's FY 1980 budget and commissioned two studies to evaluate agricultural research facilities and make recommendations for the future.

The Joint Council developed a 5-year Projection for the Food and Agricultural Sciences, which will serve as an umbrella for activities in research, extension, and teaching.

In 1980, the Joint Council will be continuing the special emphasis on improving coordination in programs initiated in 1979 and, in addition, will place special emphasis on programs in energy development and use.

Legislative Changes: SEA does not propose any changes in the legislative authority for the Joint Council at this time, other than seeking authorization for funding support.

C. How do the Joint Council and Users Advisory Board Relate?
Title XIV of the Food and Agriculture Act of 1977 requires that the Joint Council on Food and Agricultural Sciences and the National Agricultural Research and Extension Users Advisory Board hold at least one of their meetings each year as a combined meeting of the two groups. The Users Advisory Board elects two of its members to serve on the Joint Council. The intent is to further regular exchange of information and views between these representatives of users and providers of research and extension services. At the July 1980 meeting, Joint Council members reacted to Users Advisory Board priority statements made in the Users Advisory Board October 1979 report and shared perspectives on their mutual roles and needs.

V. Section 1406 of P.L. 95-113 mandates the establishment, under the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), of a Committee on Food and Renewable Resources (CFRR). The CFRR was established on June 16, 1978. We need information based on the following questions: Is the CFRR fully operative at this time? Is it fulfilling its intended role? If so, what has been its impact? If not, what are the problems that inhibit it from fulfilling its role?

The Committee on Food and Renewable Resources, called for in the Food and Agricultural Act of 1977, was chartered by the Federal Coordinating Council on Science, Engineering and Technology, June 1978.

Operation:

The purpose of CFRR is to increase the overall effectiveness and productivity of Federal research and development efforts in food, nutrition, and renewable resources. The more specific objectives of the committee are to:

- Improve planning, coordination, and communication among Federal agencies engaged in research on food and renewable resources.

- Develop and update plans for Federal research programs to meet current and future domestic and international needs for food and renewable resources.

- Collect, compile, and disseminate information on food and renewable resources research.

- Prepare reports describing activities, findings, and recommendations of the committee.

The Committee is composed of representatives from 10 departments or agencies of the Federal Government having responsibility for research in food and renewable resources. It meets at the call of the Chairman, typically two or three times a year. CFRR has two joint subcommittees:

- Aquaculture (joint with Committee on Atmosphere and Oceans)

- Human Nutrition Research (joint with Committee on Health and Medicine)

and four work groups:

- Research on Western Range Management

- Transportation and Storage Technologies

- Research on Endangered Species

- Research on Forest Resource Management

Some of these groups have been very active and some are not yet functioning. The Subcommittee on Aquaculture has been particularly productive during a time when new initiatives in aquaculture have been developed. This subcommittee was the focal point for research planning and has developed a national aquaculture plan cooperatively with industry, universities, and states. This group was also the focal point for the Executive Branch's legislative efforts in aquaculture.

The Subcommittee on Human Nutrition is another active committee serving a useful purpose. They have conducted an exhaustive inventory of research and educational activities in human nutrition throughout the Federal Government and are identifying critical national and international issues with respect to human nutrition.

Some of the special issues CFRR has identified and dealt with include:

- The development and use of recovery systems for food service installations

- o Irradiation preservation of food
- o Biomass research
- o Cellulose conversion to glucose

There were many effective interagency committees in operation before CFRR was created and it has been the Committee's policy not to duplicate those efforts. Instead, efforts have been concentrated on identifying those areas where there is no mechanism for coordination and planning and where the needs are greatest.

Impact: The CFRR has by no means accomplished all of its objectives. It is too early to reach a final conclusion about its impact. The Committee has served as a forum for exchange of information, such as budget matters relating to food and renewable resources, and serves as an additional means of linking the departments of government with major responsibility for food and agriculture.

VI. USDA is designated under Section 1405 of P.L. 95-113 as the lead Agency of the Federal Government for agricultural research. We should like your description and evaluation of efforts as the lead Agency. Specifically, describe the efforts to fulfill Section 1405 of P.L. 95-113 as they relate to agricultural research. Have these efforts been successful? If so what has been the impact? If not, what have been the problems?

A. Fulfillment of lead agency role

The USDA has been fully responsive to its lead agency mandate:

- o The Science and Education Administration was created to foster joint planning and coordination among functional areas.
- o All of the 9 areas of responsibility identified in Sec. 1405 have been significantly addressed.
- o The SEA Joint Planning and Evaluation Staff was established to strengthen planning and coordination of all agricultural research, extension, and teaching activities and perform essential staff functions in support of the intent of Section 1405.
- o The Joint Council and Users Advisory Board have been established, are in operation, and are beginning to impact beneficially on the "lead agency" role.
- o Special studies have been conducted on most of the 15 new Federal initiatives identified in Sec. 1402.08, some of which have been supported by additional funding.

B. Assessment of effectiveness

Agency leadership results from its total mode of operation. Although the USDA has acted vigorously to fulfill its mandate for leadership in the food and agricultural sciences, not all elements of its action are fully operational at this time. Moreover, budgets for food and agricultural science and education have been far below authorized appropriation levels, required to launch major new efforts in research. Agency efforts to obtain necessary budgetary support for its coordinating and leadership role in higher education have not been successful. Hence, effectiveness and impact cannot be realistically evaluated at this time. However, it may be noted that:

- o Organizational changes have been made without reducing the number of research scientists and technicians during a period of personnel ceiling restrictions.
- o Positive results and favorable response have been achieved where specific activities and institutional changes have moved beyond the point of working out procedural and communication problems.
- o A framework has been established that will accelerate progress within the next several years.

C. Overview of responsibilities

Nine specific responsibilities are identified in Sec. 1405. The following are highlights of actions taken:

1. Establish jointly with the Secretary of Health, Education, and Welfare procedures for coordination with respect to nutrition research in areas of mutual interest.

A Human Nutrition Policy Committee, established by the USDA, oversees efforts of SEA-HN to coordinate and integrate the human research, education, and information activities within the Department and to cooperate with other government agencies in the coordination of their activities with those of USDA. The "Dietary Guidelines for Americans," issued jointly by DHEW and USDA this year, is tangible evidence of effective cooperation. A special study by the Joint Council, "Research, Extension and Higher Education in Human Nutrition," issued in March 1980, provides a classification and inventory of USDA supported research, identifies needs for research, and recommends specific action to improve coordination.

2. Keep informed of developments in, and the Nation's need for, research, extension, teaching, and manpower development in the food and agricultural sciences and represent such need in deliberations within the Department of Agriculture, elsewhere within the executive branch of the United States Government, and with the several States and their designated land-grant colleges and universities, other colleges and universities,

agricultural and related industries, and other interested institutions and groups.

Major studies have been conducted or are in progress and a number of reports have been prepared on special topics. These studies and reports, together with commentary and recommendations from the Joint Council, have been useful in showing current needs and practices in the food and agricultural system. Several have been on topics that have received little or no attention previously. Examples of published reports include:

- "Graduates of Higher Education in the Food and Agricultural Sciences: An Analysis of Supply/Demand Relationships" Vol. 1, SEA, Misc. Pub. 1385, July 1980.
- "Evaluation of the Economic and Social Consequences of Cooperative Extension Programs" USDA, SEA, January 1980.
- "Report and Recommendations on Organic Farming" USDA, July 1980.
- "Proceedings of the Conference on Priorities for Agricultural Research, Extension, and Higher Education", USDA, SEA, January 27-28, 1980.
- "Research, Extension and Higher Education for Small Farms," Joint Council on Food and Agricultural Sciences, December 1979.
- "Research, Extension and Higher Education in Human Nutrition," Joint Council on Food and Agricultural Sciences, March 1980.

3. Coordinate all agricultural research, extension, and teaching activity conducted or financed by the Department of Agriculture and, to the maximum extent practicable, by other agencies of the executive branch of the United States Government.

a. Steps have been taken to improve the coordination among the Department's science and education (S&E) agencies. The Director of SEA and Administrators from ESCS, OICD, FS, and SCS, both individually and at monthly S&E coordinating meetings, discuss programs and issues of mutual concern and provide guidelines to staff to use to coordinate budget development efforts. These discussions have been reinforced by numerous review and planning sessions involving a number of agency representatives. This has led to improved coordination of budget requests, including joint budget displays in the case of SEA with FS and SEA with ESCS. A science and education overview paper for FY 1982 budget planning was developed covering SEA, ESCS, FS, SCS, and OICD. Coordination with science and education agencies outside Agriculture, such as with NSF, HHS, DOI, etc., has been more informal but useful. SEA's participation with the Federal Coordinating Council for Science,

Engineering and Technology (FCCSET) and close working relationship with OSTP are further indications of progress.

b. The Joint Council in its 1979 Annual Report to the Secretary of Agriculture, reported the following accomplishments to strengthen planning and coordination:

- o A regional and national planning structure designed to improve planning and coordination of research, extension, and higher education, was developed and is beginning to function.
- o An interim research planning committee was established to assure the continued coordination of national and regional research planning while a new structure for overall planning is being developed and implemented.
- o Special efforts were given to determining the human nutrition needs and to improving coordination of activities to meet those needs.
- o Integrated Pest Management and the program needs of small farms were subjects of special studies and coordination efforts.
- o The Joint Council sponsored the Renewable Resource Extension Act (RREA) planning efforts. It also supported a higher education manpower study and a study of facilities for food and agricultural research.

c. SEA Managers meet frequently with other advisory groups including ECOP, ESCOP, RICOP and AAUAA to discuss program priorities and areas of mutual interest.

4. Take the initiative in establishing coordination of State-Federal cooperative agricultural research, extension, and teaching programs, funded in whole or in part by the Department of Agriculture in each State, through the administrative heads of Land-Grant colleges and universities and the State directors of agricultural experiment stations and cooperative extension services, and other appropriate program administrators.

a. Coordination of State-Federal programs on a continuing basis is centered in SEA-CR for research and SEA-Extension for cooperative extension. This is supported by a number of advisory groups previously identified.

b. One of the main initiatives taken to strengthen this coordination stems from the regional and national coordination system now in process of being established by the Joint Council. This will be a principal vehicle for coordination in the future. (See Attachment 4)

c. A common program structure for coordination has been considered in a report of a Joint Council study group, "The Question of a Common Program Structure for Food and Agricultural Sciences" (April 1980), which describes the program structure presently in use in the agricultural science and education system, users of program structures and their information needs, and alternatives for arriving at a better structure.

d. Budget development planning for FY 1982 was significantly aided through joint planning effort by SEA and Action/Regulatory Agencies; SEA and other science and education agencies; and by joint planning between SEA and representatives from ESCOP, ECOP, RICOP, AAUAA and IR-6.

e. Specific examples of new or jointly coordinated State-Federal projects and programs include: Integrated Pest Management; development of a SEA Energy Program and Plan; development of a national plan for New Initiatives in Home Economics Research, Extension and Higher Education.

5. Consult the Joint Council, Advisory Board, and other appropriate advisory committees of the Department of Agriculture in the formulation of basic policies, goals, strategies, and priorities for programs of agricultural research, extension, and teaching.

Substantive, useful discussion has taken place at each meeting of the Joint Council, UAB, and numerous other bodies. Comment and advice from these are received and considered, and are documented in SEA budget submissions. Sources of counsel and action include:

a. Joint Council--Activities and recommendations are summararized in:

- "1979 Annual Report to the Secretary of Agriculture" (March 1980)
- "Areas of Emphasis in the Food and Agricultural Sciences for the Early 1980's" (March 1980)

b. Users Advisory Board--Activities and recommendations are summarized in:

- "Report of the National Agricultural Extension Users Advisory Board" (October 1979)
- "Report to the President and Congress" (March 1980)

c. ESCOP, ECOP, RICOP, NASULGC, AAUAA--Three to four meetings are held each year by SEA with representatives of these bodies to obtain

advice on budget priorities. SEA staff regularly attend and participate in scheduled meetings of these bodies.

d. American Association of University Agricultural Administrators, Association of Administrators of Home Economics, National Council of Home Economics Administrators--These associations include in their combined membership both Land-Grant and Non-Land-Grant administrators. SEA staff regularly participate in their meetings to keep the associations informed and receive advice and comment.

e Professional societies--Consultation on budget priorities is documented in "Proceedings of the Conference on Priorities for Agricultural Research, Extension and Higher Education," (January 17-28, 1980, Arlington, VA).

6. Report (as a part of the Department of Agriculture's annual budget submissions) to the House Committee on Agriculture, the House Committee on Appropriations, the Senate Committee on Agriculture, Nutrition, and Forestry, and the Senate Committee on Appropriations actions taken to support the recommendations of the Advisory Board.

The Users Advisory Board, in its October 1979 report, recommended special attention and increased funding for nine areas of emphasis. The Department's response to these recommendations, transmitted to the Congress as directed, was made available to the Users Advisory Board at its meeting of February 18-20, 1980, in Orlando, Florida.

7. Establish appropriate review procedures to assure that agricultural research projects are timely and properly reported and published and that there is no unnecessary duplication of effort or overlapping between agricultural research units.

a. SEA-Agricultural Research review procedures include both (1) an initial formal review of project proposals via the project system and (2) annual reviews thereafter for the life of the project. Project reviews include reviews by peers within the units of SEA as well as other agencies in the Department with common research interests. Annual project reviews result in documents such as Work Reporting Units (WRU) reports and plans and resource management plans. Onsite, annual program reviews in regions, conducted by regional management and National Program Staff, use these documents as source material for program evaluation.

b. SEA-Cooperative Research staff scientists review every State project before it is approved for Federal funding. Annual progress reports also are required on each project, so that another check can be made. Periodically, the staff review research onsite in the States. The review may focus on each individual project, research concerned with single commodities, the entire department involved in the research program, and/or the entire research program and plans of the research unit--depending on the judgment of SEA-CR and the State research administrators involved. The objective is to provide as much help and

guidance as possible and needed to the research program. Increasingly, these reviews are done by peer panels of competent scientists and administrators from SEA-CR, from other agricultural experiment stations, and from outside institutions cross the country.

c. The extensive review of current programs across all SEA units as a part of budget planning and development serves as a further guard against unnecessary duplication. This is activated in a program-by-program review conducted by teams which include representatives from each SEA unit.

8. Establish Federal or cooperative multidisciplinary research teams on major agricultural research problems with clearly defined leadership, budget responsibility, and research programs.

Multidisciplinary team efforts have been undertaken in many problem areas in which the approach is advantageous. Selected examples are:

a. An interdisciplinary task force for Agricultural energy has been established to develop a SEA energy plan. This Federal-State task force includes engineers, economists, soil scientists, plant scientists, home economists, and others.

b. Integrated Pest Management--A multidisciplinary team has been named at the SEA level and committees have been established in each region. The Joint Council held a symposium on planning and coordination of Integrated Pest Management Programs, during which the Council reviewed related areas of crop production, pest problems, climate and pest management, tillage practices, and use of agrichemicals to control pest damage on crops. The Consortium for Plant Protection, Experiment Station Committee on Organization and Policy (ESCOP), sponsored "Integrated Pest Management: A Program of Research for the State Agricultural Experiment Stations and the Colleges of 1890," September 1979.

c. A National Dairy Forage Research Laboratory is being constructed in Madison, Wisconsin and will have seven cluster locations located at State Agricultural Experiment Stations. The center will meet the need for research information on forage production and utilization.

d. Fifteen Decision Unit teams and 45 Special Analyses teams were used to help SEA to develop its FY 1982 budget request and to coordinate this with other agencies.

e. Some additional areas where multidisciplinary teams have been used to conduct significant studies include organic farming, small farms, aquaculture, a special analyses of basic research needs, a national manpower study, and evaluation of the social and economic impacts of extension.

9. In order to promote the coordination of agricultural research of the Department of Agriculture, conduct a continuing inventory of ongoing

and completed research projects being conducted with or funded by the Department.

This has been done through annual and special purpose inventories based on the Current Research Information System (CRIS), which have been compiled since 1966. Also, the Interim National Research Planning Committee in July 1980, published the report on 1979-84 projections based on CRIS data and future plans of research administrators in the Department and in the States.

Efforts to implement the lead agency mandate and specific responsibilities for new program initiatives and coordination have accentuated some of the limitations of this system, although it continues to provide data superior to other sources of data on publicly supported agricultural research. Difficulties stem from lack of currentness in information because of lag time in obtaining and entering annual reports, and from classification rigidity which inhibits rapid and efficient use under changing program priorities. The Department is aware of these problems and is seeking solutions. The report to the Joint Council on "The Question of a Common Program Structure for the Food and Agricultural Science" (April 1980) and follow up action taken by the Joint Council provides a basis for developing more efficient and adaptable technical and management information and systems.

ATTACHMENT 1.

U. S. DEPARTMENT OF AGRICULTURE

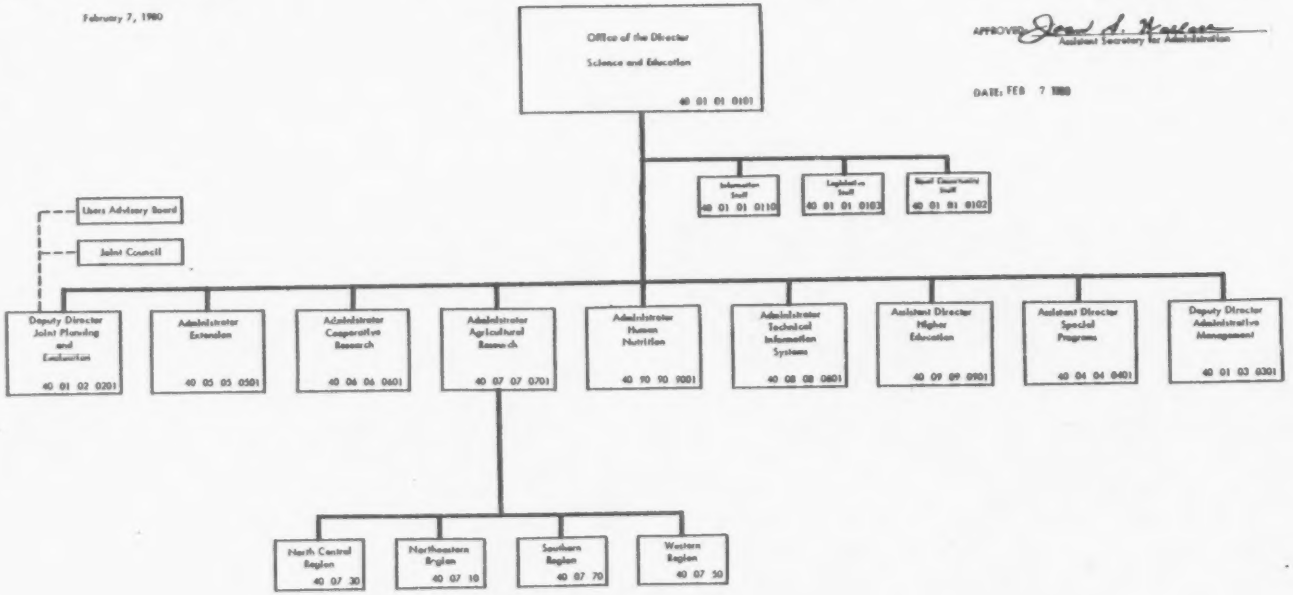
SCIENCE AND EDUCATION ADMINISTRATION

February 7, 1980

RECOMMENDED: _____ Director, Science and Education

APPROVED: _____ Assistant Secretary for Administration

DATE: FEB 7 1980



Supersedes SEA chart dated October 26, 1979.

Prepared by Organization and Management Development Staff, SEA, Hyattsville, Maryland.

MISSION: In cooperation with Federal departments and agencies, the States, State agricultural experiment stations, colleges and universities, and user groups, the Science and Education Administration conducts and supports research, extension, and teaching programs in the food and agricultural sciences responsive to local, State, regional, national and world needs, including: human nutrition, home economics, consumer services, family life, rural and community development, agricultural energy, agricultural economics, environmental quality, natural and renewable resources, forestry, range management, animal and plant production and protection, aquaculture, and the processing, distribution, marketing, and utilization of food and agricultural products.

11-864 O - 83 - 5

U. S. DEPARTMENT OF AGRICULTURE

SCIENCE AND EDUCATION ADMINISTRATION

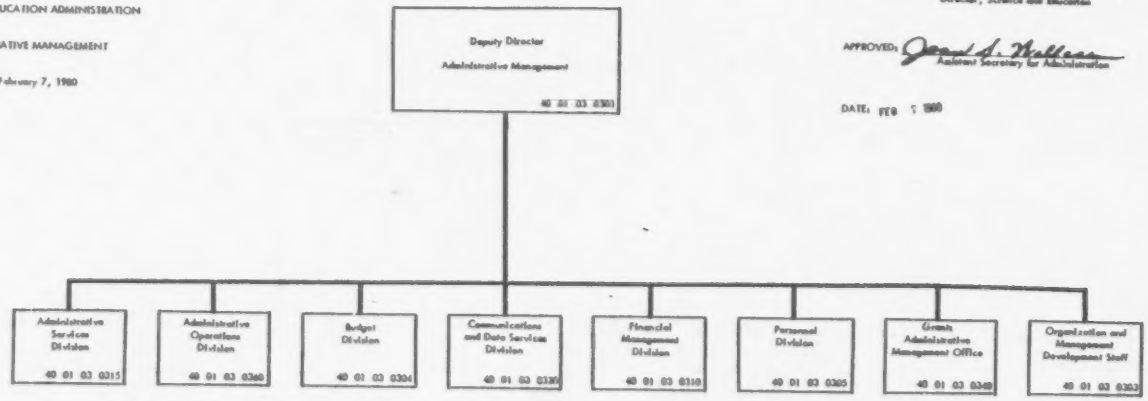
ADMINISTRATIVE MANAGEMENT

February 7, 1980

RECOMMENDED: Director, Science and Education

APPROVED: Assistant Secretary for Administration

DATE: FEB 7 1980



Supersedes Administrative Management portion of SEA chart, dated October 26, 1978.

Prepared by Organization and Management Development Staff, SEA, Hyattsville, Maryland.

U. S. DEPARTMENT OF AGRICULTURE

SCIENCE AND EDUCATION ADMINISTRATION

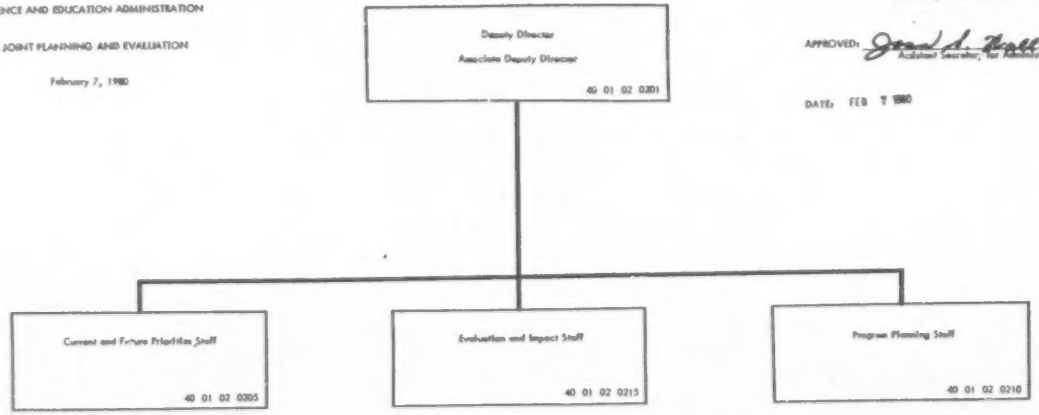
JOINT PLANNING AND EVALUATION

February 7, 1980

RECOMMENDED: _____ Director, Science and Education

APPROVED: _____ Assistant Secretary, for Administration

DATE: FEB 7 1980



Prepared by Organization and Management Development Staff, SEA, Hyattsville, Maryland.

Supersedes Joint Planning and Evaluation portion of SEA chart, dated October 26, 1978.

U. S. DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH SERVICE

MASTER CHART OF ARS REGIONS

Western Region - Berkeley, California
North Central Region - Peoria, Illinois
Southern Region - New Orleans, Louisiana
Northeastern Region - Beltsville, Maryland

January 16, 1977

APPROVED: _____

DATE: January 16, 1977

REGION

OFFICE OF DEPUTY ADMINISTRATOR

Program Formulation. Participates with the Administrator, Program Analysis and Coordination Staff, and National Program Staff in developing national programs, research goals, and objectives. Develops and implements, in consultation with State research leaders, industry, and other Federal agencies, and within national plans and objectives, cooperative regional research programs to meet the needs of the region.

Executive Direction. Under broad delegations of authority and responsibility from the Administrator, provides administrative and program management leadership, direction, control, and coordination for ARS programs within the region.

Cooperative Relations. Represents ARS in planning and coordinating research programs with the appropriate Regional Associations of State Experiment Station Directors and their regional technical committees.

PROGRAM PLANNING AND REVIEW STAFF

Provides staff support in planning, programming, and evaluating research programs at the Region, cooperating with the National Program Staff and the Program Analysis and Coordination Staff in the development of national programs, goals, and objectives, as well as the Area and Research Center Directors and Research Leaders in the development of Area and Research Center programs, and research activities of ARS Field locations and reviews and coordinates program inputs to program, information, and budgetary systems for the region.

REGIONAL ADMINISTRATIVE OFFICE

Provides administrative management support services for regional research program including:

Budget and Fiscal. Provides financial information and assistance to the regional Deputy Administrator in budget formulation, developing annual year operating budget. Maintains fiscal records and prepares special fiscal and budgetary reports.

General Services. Provides general services support, including procurement and contracting, construction, real and personal property, records management, research contracts, grants, cooperative agreements, and related activities.

Personnel. Provides personnel services support including recruitment and placement, position classification, wage administration, employee development, Equal Employment Opportunity, labor management relations, safety and employee relations.

REGIONAL INFORMATION OFFICE

Provides informational staff support for the ARS research programs and cooperates with the Information Division in recommending agency policies relating to:

(a) production, editing, and distribution of technical and popular publications;
(b) dissemination of research findings to all media for the benefit of farm, agribusiness, consumer, and other public interests;
(c) coordination of ARS information activities with State agricultural editors.

BIOMETRICAL AND STATISTICAL SERVICES STAFF

Provides biometrical, statistical, and mathematical consultation and services to program managers and scientists of the Region in the areas of experimental and sampling designs; procedures for data collection; mathematical models representing physical and biological systems; and data analysis and interpretation.

AREA OFFICES AND RESEARCH CENTERS

Program Formulation. Participates with the regional Deputy Administrator and appropriate State research leaders in the formulation of cooperative research activities at field locations within the region which contribute to, and are an integral component of, the ARS National Research Program.

Program Direction. Within broad authorities delegated by the regional Deputy Administrator provides administrative and program leadership, supervision, and coordination of programs within the Area or at the Center.

The titles and locations of Area Offices and Research Centers in each Region are listed below.

WESTERN REGION

Arizona - New Mexico Area	Tucson, Ariz.
California - Hawaii - Nevada Area	Fresno, Calif.
Colorado - Wyoming Area	Fort Collins, Colo.
Idaho - Montana - Utah Area	Logan, Utah
Oregon - Washington Area	Pullman, Wash.
Western Regional Research Center	Albany, Calif.

NORTH CENTRAL REGION

Illinois - Indiana - Ohio Area	West Lafayette, Ind.
Michigan - Minnesota - Wisconsin Area	St. Paul, Minn.
Mid-Great Plains Area (Iowa, Kansas, Missouri, Nebraska)	Columbia, Missouri
Dakotas - Alaska Area	Fargo, N. Dak.
Northern Regional Research Center	Peoria, Ill.
National Animal Disease Center	Ames, Iowa

SOUTHERN REGION

Florida - Antilles Area (Fla., P.R., V.I.)	Gainesville, Fla.
Athens, Georgia Area	Athens, Ga.
Georgia - South Carolina Area	Tifton, Ga.
Alabama - North Mississippi Area	Mississippi State, Miss.
Mississippi Valley Area (Miss., La., Ark.)	Stoneville, Miss.
Mid-Atlantic Area (N.C., Tenn., Ky., Va.)	Raleigh, N. C.
Oklahoma - Texas Area	College Station, Tex.
Lubbock - Texas Area	Weslaco, Tex.
Southern Regional Research Center	New Orleans, La.

NORTHEASTERN REGION

Chesapeake - Potomac Area (Del., Md., W. Va., Wash. D.C.)	Hyattsville, Md.
North Atlantic Area (N.Y., Pa., N.J., Vt., N.H., Maine, Conn., Mass.)	Ithaca, N. Y.
Beltsville Agricultural Research Center	Beltsville, Md.
Plum Island Animal Disease Center	Orient Point, N. Y.
Eastern Regional Research Center	Wyndmoor, Pa.

Supersedes chart dated October 12, 1972.

Prepared by Management Improvement Staff, Hyattsville, Maryland.

U. S. DEPARTMENT OF AGRICULTURE
SCIENCE AND EDUCATION ADMINISTRATION
AGRICULTURAL RESEARCH
December 29, 1978

RECOMMENDED: [illegible]
Acting Director for Agricultural Research

APPROVED: [illegible]
Director, Science and Education

DATE: December 29, 1978

DEPUTY DIRECTOR
ASSOCIATE DEPUTY DIRECTOR

PESTICIDE IMPACT ASSESSMENT STAFF

Assignment of Functions

1. Provides technical advice on pesticides employed in plant protection for use in formulating Agency policy concerning pesticide assessment and the related national agricultural research programs.
2. Provides leadership in pesticide assessment issues in the development of evaluations related to registration of pesticides, including the coordination of these assessments with the Environmental Protection Agency.
3. Carries out a continuous program of review and analysis of the AR research programs on pesticides and determines their effectiveness in furnishing technical data related to pesticides assessment.

ASSISTANT DEPUTY DIRECTOR
NATIONAL PROGRAM STAFF

NATIONAL TECHNICAL EDITING STAFF

Assignment of Functions

1. Provides technical editing service to scientists on manuscripts to be published in a wide variety of scientific and technical journals.
2. Representing the Deputy Director's Office, provides policy guidance for clearance of potentially sensitive publications and information releases.
3. Maintains central files on authorship of articles published in journals and responding to requests for reprints for outside scientists.
4. Reviews and approves all sensitive matters in manuscripts dealing with pesticides and environmental quality in order to insure consistency with USDA policy. In this regard, serves as consultant to authors concerning matters involving sensitivity in Department policy. Reviews all bulletins, leaflets, program aids, and miscellaneous publications that contain recommendations for fertilizer, chemicals, herbicide, pest control, and other sensitive items to confirm that all recommended practices are in agreement with accepted policies and procedures and as necessary provides leadership in updating these publications.

ASSISTANT TO DEPUTY DIRECTOR
PROGRAM OPERATIONS

1. Provides special assistance to the Deputy Director and Associate Deputy Director in all areas related to program operations in AR including the direction and coordination of research programs, the development of plans and budgets, and special policies and program guidelines for new programs affecting AR.
2. Coordinates or chairs special and standing committees and programs that affect or determine broad policies, goals, and operations of AR, i.e., the AR Budget Steering Committee, the Authorization Development Reviewing Program, and Interim Coordinating Committee on Four Pilot Technology Research Assessment.
3. Maintains a national overview in the coordination of regional statistical consultants, lab automation and monitoring, and computer consultion for programs and activities in AR.
4. Coordinates the development of special policy papers and reports, i.e., a feasibility study on a Plum Island and Gulf Stations Conservation Lab; the development of special planning sessions as may be required between AR and other agencies and special feasibility studies for new areas of research.
5. Supervises the Radiological Safety Staff.

RADIOLOGICAL SAFETY STAFF

Assignment of Functions

1. Ensures adequate control and the maintenance of proper safeguards regarding radiological safety within the Department of Agriculture, including control of the possession, use, and disposition, from the standpoint of radiological safety, of all materials and equipment which are sources of natural and potential radiation hazards.
2. Serves in concert with Department agencies on all matters requiring approval of the Radiological Safety Committee and provides information and instructions relative to requirements for such approval.

LIVESTOCK AND VETERINARY SCIENCES STAFF

FOOD HARVEST SCIENCE & TECHNOLOGY STAFF

CROP PRODUCTION STAFF

CROP PROTECTION STAFF

SOIL, WATER, & AIR SCIENCES STAFF

A. General

The National Program Staff functions as a policy and program development, review, and evaluation staff, documenting area planning for program interaction, balance, and distribution of research effort and focusing upon major national policy and program issues. This serves as the Deputy Director's principal staff arm for exercising his authority in managing AR programs nationally.

B. Assignment of Functions

1. Participates with Assistant Deputy Director and other AR officials to assure the integration and coordination of research programs across Regions, disciplines, and commodities.
2. Provides day-to-day expert technical leadership and guidance to scientific personnel throughout the AR organization.
3. Plans and conducts national workshops which provide interaction of research leaders and regional and area managers across regional and area lines in the pursuit of national program objectives.
4. Develops the National Research Planning structures which describe the AR national programs and technological objectives and serves as the guide for the development and coordination of research plans at countless within the field organization.
5. Participates with the Assistant Deputy Director in the development of a nationwide system of technical advisors in AR.
6. Assists the Deputy Director in the preparation, presentation, and defense of the AR budget.
7. Maintains close liaison with the Joint Planning and Evaluation staffs to assure the coordination of AR programs with overall Agency goals and needs.

REGIONAL ADMINISTRATOR
NORTH CENTRAL REGION

REGIONAL ADMINISTRATOR
NORTHEASTERN REGION

REGIONAL ADMINISTRATOR
SOUTHERN REGION

REGIONAL ADMINISTRATOR
WESTERN REGION

Participates with the Deputy Director and other headquarters staffs in establishing policy for all aspects of program planning, evaluating, budgeting, and coordination with emphasis on matters relative to the assigned Region, as well as their relationship to national programs, goals, and objectives. Responsible for administering research projects of the national programs assigned to their Regions. Cooperates and coordinates Cross Department Sections, Federal and State agencies in the conduct of the regional programs.

NFR CHART

U. S. DEPARTMENT OF AGRICULTURE
SCIENCE AND EDUCATION ADMINISTRATION
COOPERATIVE RESEARCH

RECOMMENDED: Walter J. Kromer
Administrator, Cooperative Research

APPROVED: [illegible]
Director, Science and Education

DATE: [illegible]

ADMINISTRATOR
ASSOCIATE ADMINISTRATOR

NATURAL RESOURCES

The Natural Resources program includes planning and coordination of research activities related to production, harvesting, utilization and conservation of forest and range resources including water, wildlife and recreation; and characteristics, management, health, and classification; water quality, management and supply; climate and weather; agricultural energy, water, use and conservation; agricultural engineering including tillage, harvesting, processing and materials handling tools and agricultural engineering include interactions with plant, animal, and food sciences.

PLANT SCIENCES

The Plant Sciences program focus on the planning and coordination of research activities related to the production, harvesting, and protection of crops and forage, and covering the areas of crop culture, forage and range, horticulture, weed science, plant pathology, entomology, and basic plant sciences. Supported in the Plant Sciences program are plant genetics and breeding, nutrition, DNA, plant physiology and biochemistry, plant germplasm resources, pesticide impact assessment, and management, biological control of pests, crop loss assessment, and atmospheric deposition.

ANIMAL SCIENCES

The Animal Sciences program is involved in the planning and coordination of research activities related to the production and protection of dairy, beef cattle, sheep, goats, poultry, and nonhuman species, including fishes and other aquatics, genetics, breeding, nutrition, physiology, tissue growth, management, waste disposal and utilization, environmental factors, and product quality.

HUMAN NUTRITION, FOOD AND SOCIAL SCIENCES

The Human Nutrition, Food and Social Sciences program is involved with planning and coordination of research programs and strategies related to human nutrition, food consumption, consumer protection and home economics food sciences, including food chemistry, engineering, microbiology, processing and safety, and storage and utilization of food; economics of natural resources, food and fiber production, marketing, and distribution; natural resources, environmental and agricultural policies; sociological and behavioral, including education and communication, aspects of individuals, families, communities, institutions and agriculture in rural areas.

COMPETITIVE RESEARCH GRANTS OFFICE

This office makes grants in areas of basic research identified as having the greatest potential for furthering the programs of the Department of Agriculture. Grants are awarded to state and private universities and colleges, to State Agricultural Experiment Stations, to Federal agencies, to private organizations or associations and to individuals. The program seeks to stimulate the participation of outstanding researchers in the entire U.S. scientific community. Programs currently support basic research critical to food production and human nutrition in the areas of biological stress on plants, genetic mechanisms of plants, plant nitrogen fixation, plant photosynthesis and human nutrient requirements.

A. General

Cooperative Research administers the Acts of Congress [illegible] agricultural research authorized by the State agricultural experiment stations, colleges of veterinary medicine, 1890 land-grant institutions and Tuskegee Institute, approved schools of forestry, and other eligible institutions in support of the efficient production, marketing, distribution, and utilization of crops and livestock. Improvement of health and human nutrition, the efficient management of natural resources and enhancement of rural America in their broad aspects including meeting the needs of the consumers and the people in rural America.

B. Assignment of Functions

1) Approves research proposals and disbursement of funds on approved projects and programs.
2) Reviews programs and provides technical and administrative assistance to directors of research and persons/institutions conducting research.
3) Participates in regional and national planning and program improvement activities and in other processes to develop research needs and priorities.
4) Carries out congressionally mandated responsibilities for coordination among cooperating State research institutions and between them and the U.S. Department of Agriculture and participates in other coordination mechanisms between SEA, the Forest Service, ARS and State research organizations.
5) Represents State cooperators and CR on committees and task forces concerned with international scientific cooperation across all program areas.
6) Serves as a means of interaction of SEA with rural programs of State cooperating research institutions.
7) Participates in interdisciplinary assessment and planning teams in the Department and with other Federal agencies and institutions.
8) Maintains familiarity with rural research programs and resources of cooperating State research institutions, and utilizes their expertise and accomplishments in the purposes and functions of SEA, the Department, and other Federal agencies.
9) Special Grants.

Provides leadership and guidance for farmers, research activities within CR and for coordination among cooperating farmers, schools and participating State agricultural experiment stations and between them and the Forest Service for farmers research.

Provides leadership and guidance in the 1890 College and University System and Tuskegee Institute, toward the development of programs and research strategies in planning and conducting agricultural research in cooperation with each other and each other institutions as may contribute to the solution of agricultural problems.

Provides leadership on the development and funding of cooperative research under Sections 1434 and 1473 of P.L. 95-113, on energy substitution, conservation, and accompanying related to agriculture and rural resources. Through contact with DOE and EPA, identifies targets of opportunity and guides the development of SAES research emphasizing technologies and systems to conserve and replace petroleum and natural gas by greater use of renewable energy sources. Works and participates with SEA Planning Committee for energy research and development programs.

The state guidelines for Cooperative Research provide cooperation on research of a regional and national character both among state agricultural experiment stations (SAES) and with USDA, as provided in Section 5(c) 3 of P.L. 89-352 under the Hatch Act.

Works with the Committee of 9 which makes final recommendations to the Secretary on priority areas of funding for regional research. Works with regional organizations and associations to ensure that regional needs and priorities are reflected in the development of national priorities.

Provides leadership in the development and funding of cooperative programs for particular impact assessment and integrated pest management. Works with Department committees and insures full involvement of cooperators. Recommends appropriate proposals for funding under CR funding authorities.

Recommends research proposals on problems of national scope identified by the Department and by Congress when the research involves a degree of uncertainty beyond the normal emphasis in the formula grant program. Directs and coordinates recommendations of staff experts and national scientific community in identifying agency-wide research strategies for Special Grant funding. Participates the allocation and financial accounting of special grant funds in centers of funding mechanisms, including those available under the Grants for Agricultural Research (Sec. 4, 1958, 63 USC 1851-55), the Act of August 4, 1965, 7 USC 450b, and as amended by P.L. 95-113, Sept. 29, 1977.

Provides leadership and guidance for administration of animal health research funded under Title XIV of P.L. 95-113. This includes the formula funded research program authorized under Section 1433 and the National and Regional Animal Health and Disease program authorized under Section 1434. Provides Executive Secretary support to the Animal Health Science Research Advisory Board.

Provides leadership, guidance and coordination of programs of research in rural development and small farms as provided for in the Rural Development Act of 1972, P.L. 92-419, as amended, including Rural Development Centers. Provides leadership and liaison with home economics research throughout the Nation as prescribed by in Title XIV of P.L. 95-113 of the Food and Agriculture Act of 1977. Works with Departmental and interdepartmental committees and insures full involvement of cooperators in national programs. Represents cooperators in Consumer Affairs activities.

Maintains continuing review of policies of Promotion of Human Subjects in research activities of cooperators (Secretary's Memorandum No. 1755, and P.L. 93-348, as implemented by Part 46 of the code of Federal Regulations, as amended 06/27/84).

This office shares the above items in Assignment of Functions with the other programs. Provides leadership and guidance for basic research activities within CR and relates to research institutions outside the traditional CR partnership partners as well as those within the partner. Works with a Policy Advisory Committee to establish sound policy and to assess new areas of research support activities. Works with peer panels in the program areas to evaluate research proposals and to develop funding recommendations. Makes grants as authorized by Section 2(b) of P.L. 89-106 as amended. Works with NSF, DOE, and NIH to develop a comprehensive system of basic research funding and coherent application of grants management.

NEW CHART

State Agricultural Experiment Stations of the 50 States, the District of Columbia, Puerto Rico, Guam, and the Virgin Islands
1890 Land-Grant Institutions and Tuskegee Institute
Cooperating Schools of Forestry Institutes
Schools of Veterinary Medicine

U. S. DEPARTMENT OF AGRICULTURE

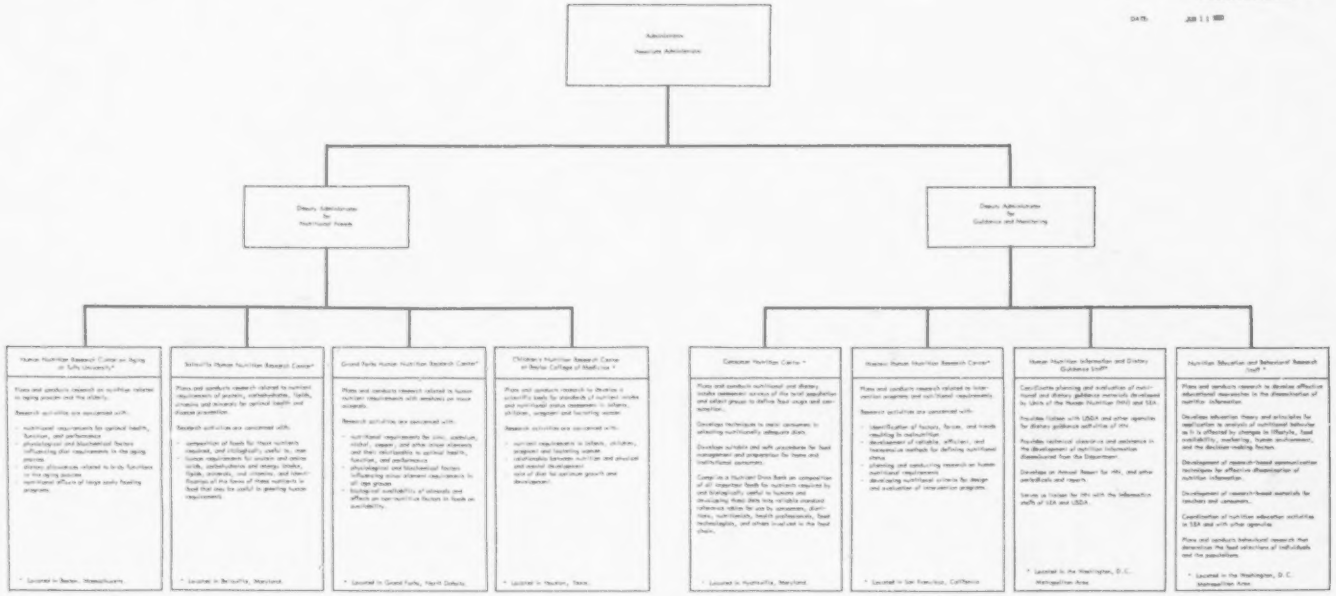
SCIENCE AND EDUCATION ADMINISTRATION

HUMAN NUTRITION

RECOMMENDED: Administrator, Human Nutrition

APPROVED: Director, Science and Education

DATE: JUN 11 1980



NEW CHART

Issued by Organization and Management Development Staff, SEA

UNITED STATES DEPARTMENT OF AGRICULTURE

SCIENCE AND EDUCATION ADMINISTRATION

40 01 01 0101 Office of the Director

A. Assignment of Functions

1. Provides national leadership and coordination for agricultural research, extension, and teaching programs in the food and agricultural sciences (includes human nutrition, home economics, consumer services, family life, rural and community development, agricultural energy, agricultural economics, environmental quality, natural and renewable resources, forestry, range management, animal and plant production and protection aquaculture, and the processing, distribution, marketing, and utilization of food and agricultural products) conducted or financed by the Department of Agriculture and, to the maximum extent practicable, by other Federal Departments and agencies pursuant to the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (7 U.S.C. 3121).

2. Administers a cooperative agricultural extension program related to agriculture, uses of solar energy with respect to agriculture and home economics under the Smith-Lever Act as amended (7 U.S.C. 341-349).

3. Cooperates with the States for the purpose of encouraging and assisting them in carrying out research related to the problems of agriculture in its broadest aspects under the Hatch Act as amended (7 U.S.C. 361a-361i).

4. Supports agricultural research at eligible institutions in any State through Federal-grant funds to help finance physical facilities (7 U.S.C. 390-390k).

5. Conducts research concerning domestic animals and poultry, their protection and use, causes of contagious, infectious, and communicable diseases and means for the prevention and cure of the same (7 U.S.C. 391).

6. Conducts research related to the dairy industry and dissemination of information for the promotion of the dairy industry (7 U.S.C. 402).

7. Conducts research and demonstrations at Mandan, N. Dak., and Lewisburg, Tenn., concerning dairy livestock breeding, growing, and feeding, and other problems pertaining to the establishment of dairy and livestock industries (7 U.S.C. 421-422).

8. Conducts research on new uses for cotton and on cotton ginning and processing (7 U.S.C. 423-424).

9. Conducts research into the basic problems of agriculture in its broadest aspects, including, but not limited to, production, marketing (other than statistical and economic research but including consumer and food economic research), distribution, processing, utilization of plant and animal commodities, problems of human nutrition, development and animal commodities, problems of human nutrition, development of markets for agricultural commodities, discovery, introduction, and breeding of new crops, plants, and animals both foreign and native; conservation development, and development of efficient use of farm buildings, homes, and farm machinery, including the application of electricity and other forms of power and research and development related to uses of solar energy with respect to farm buildings, farm homes, and farm machinery (7 U.S.C. 427, 2201, 2204).

10. Conducts research on varietal improvement of wheat and feed grain to enhance their conservation and environmental qualities (7 U.S.C. 428b).

11. Advances the livestock and agricultural interests of the United States including the breeding of horses suited to the needs of the United States (7 U.S.C. 437).

12. Enters into agreements with and receives funds from any State or political subdivision, organization, or person for the purpose of conducting cooperative research projects (7 U.S.C. 450a).

13. Administers a program of competitive, special, and facilities grants to State agricultural experiment stations, colleges and universities, other research institutions and organizations, Federal agencies, private organizations or corporations and individuals to promote research in food, agricultural, and related areas (7 U.S.C. 450i).

14. Conducts research related to soil and water conservation, engineering operations, and methods of cultivation to provide for the control and prevention of soil erosion (7 U.S.C. 1010, 16 U.S.C. 590a).

15. Maintains four regional research laboratories and conducts research at such laboratories to develop new scientific, chemical, and technical uses and new and extended markets and outlets for farm commodities and products and byproducts (7 U.S.C. 1292).

16. Conducts a special cotton research program designed to reduce the cost of producing upland cotton in the United States (7 U.S.C. 1441-note).

17. Conducts research, educational, and demonstration work related to the distribution and marketing of agricultural products under the Agricultural Marketing Act of 1946 as amended (7 U.S.C. 1621-1627).

18. Administers and coordinates a foreign contracts and grants program of market development research in the physical and biological sciences under section 104(b)(1) of the Agricultural Trade, Development, and

Assistance Act of 1954, but excluding agricultural economics research; and administers and coordinates a foreign contracts and grants program of agricultural and forestry research under Section 104(b)(3) of such Act (7 U.S.C. 1704(b),(1),(3)).

19. Conducts research in tropical and subtropical agriculture for the improvement and development of tropical and subtropical food products for dissemination and cultivation in friendly countries as provided by the Food for Peace Act of 1966 (7 U.S.C. 1736(a)(4)).

20. Conducts research to develop and determine methods of humane slaughter of livestock (7 U.S.C. 1904).

21. Accepts gifts and orders disbursements from the Treasury for the benefit of the National Agricultural Library or for carrying out any of its functions (7 U.S.C. 2264-2265).

22. Administers in cooperation with the States a cooperative rural development and small farm research and extension program under the Rural Development Act of 1972 as amended (7 U.S.C. 2661-2670).

23. Administers a cooperative extension program under the Farmer-to-Consumer Direct Marketing Act of 1976 (7 U.S.C. 3004).

24. Conducts a program of grants to States to establish or expand schools of veterinary medicine (7 U.S.C. 3151).

25. Conducts a program of (i) competitive grants to colleges and universities and (ii) predoctoral and postdoctoral fellowships, to further education in the food and agricultural sciences (7 U.S.C. 3152).

26. Administers the National Agricultural Research Award for research or advanced studies in the food and agricultural sciences (7 U.S.C. 3153).

27. Makes grants to colleges and universities for research on the production and marketing of alcohols and industrial hydrocarbons from agricultural commodities and forest products and agricultural chemicals and other products from coal derivatives (7 U.S.C. 3154).

28. Administers a national food and human nutrition research and extension program under the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (7 U.S.C. 3171-3177).

29. Administers an animal health and disease research program under the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (7 U.S.C. 3191, 3193, 3195, 3201).

30. Supports continuing agricultural and forestry extension and research at 1890 land-grant colleges including Tuskegee Institute (7 U.S.C. 3221, 3222).

40 01 01 0101 C

31. Administers in relation to uses of solar energy (i) a competitive research grants program, (ii) a solar energy research information system, (iii) a cooperative program with the States on model farms and demonstration projects, and (iv) a program of research, extension, and demonstration at regional solar energy research and development centers (7 U.S.C. 3241, 3251, 3261-3263, 3271, 3281-3282).

32. Cooperates and works with national and international institutions and other persons throughout the world in the performance of agricultural research and extension activities (7 U.S.C. 3291).

33. Conducts educational and demonstration work in cooperative farm forestry program (16 U.S.C. 568).

34. Cooperates with the States for the purpose of encouraging and assisting them in carrying out programs of forestry research (16 U.S.C. 582a-582a-7).

35. Authorizes the use of the 4-H Club name and emblem (18 U.S.C. 707).

36. Maintains a National Arboretum for purpose of research and education concerning tree and plant life; accepts and administers gifts or devises of real and personal property for the benefit of the National Arboretum; and order disbursements from the Treasury (20 U.S.C. 191-195).

37. Conducts research on foot-and-mouth disease and other animal diseases (21 U.S.C. 113a).

38. Conducts research on control and eradication of cattle grubs (screw-worms) (21 U.S.C. 144e).

39. Conducts research, demonstration, and promotion activities related to farm dwellings and other buildings for the purpose of reducing costs and adapting and developing fixtures and appurtenances for more efficient and economical farm use (42 U.S.C. 1476(b)).

40. Makes grants for the support of basic scientific research at nonprofit organizations whose primary purpose is the conduct of scientific research (42 U.S.C. 1891).

41. Conducts research on losses of livestock in interstate commerce due to injury or disease (45 U.S.C. 71 note).

42. Administers the Virgin Islands agricultural research program (48 U.S.C 1409m-0).

43. Conducts research related to the use of domestic agricultural commodities for the manufacture of any material determined to be strategic and critical or substitute therefor, under section 7(b) of the

Strategic and Critical Materials Stock Piling Act (50 U.S.C. 98f).

44. Administers a cooperative agricultural extension program related to agriculture, uses of solar energy with respect to agriculture and home economics in the District of Columbia (D.C. Code Section 31-1719).

45. Provides leadership and direct assistance to the Cooperative Extension Service in planning, conducting, and evaluating extension programs under a memorandum of agreement with the Bureau of Indian Affairs dated May 1956.

46. Exercises responsibilities of the Secretary under regulations dealing with Equal Employment Opportunity in the Cooperative Extension Service (7 CRF 18).

47. Represents the Department on the Federal Interagency Council on Education.

48. Develops and maintains library and information systems and networks and facilitates cooperation and coordination for the agricultural libraries of colleges, universities, Department of Agriculture, and their closely allied information gathering and dissemination units in close conjunction with private industry and other research libraries (7 U.S.C. 2201, 2203, 3126).

49. Assures the acquisition, preservation and accessibility of all information concerning food and agriculture by providing leadership to and coordination of the acquisition programs and related activities of the library and information system, and the agencies of USDA, other Federal Departments and agencies, State agricultural experiment stations, colleges and universities, and other research institutions and organizations.

50. Formulates, writes, and/or prescribes bibliographic and technically related standards for the library and information services of USDA.

51. Determines by survey and other appropriate means the information needs of the Department's scientific, professional, technical and administrative staffs, its constituencies and the general public in the areas of food, agriculture, the environment, and solar energy.

52. Represents the Department on all library and information science matters before Congressional Committees and appropriate commissions, and provides representation to the coordinating committees of the Federal and State governments concerned with library and information science activities.

53. Represents the Department in international organizational activities and on international technical committees concerned with library and information science activities.

40 01 01 0101 E

54. Prepares and disseminates computer bibliographic files, indexes and abstracts, bibliographies, review, and other analytical information tools.

55. Copies and delivers on demand selected articles and other materials from its collections by photographic reproduction or other means within the permissions, constraints and limitations of Sections 106, 107, and 108 of the Copyright Act of October 19, 1976 (Title 17, U.S. Code).

56. Arranges for the consolidated purchasing and dissemination of indexes, abstracts, journals and other widely used information publications and services.

57. Provides assistance and support to professional organizations concerned with library and information science matters and issues.

58. Pursuant to authority delegated by the Administrator of the General Services Administration to the Secretary of Agriculture in 34 FR 6406, 36 FR 1293, 36 FR 18440, and 38 FR 23838, appoints uniformed armed guards as special policemen, makes all needful rules and regulations, and annexes to such rules and regulations such reasonable penalties, (not to exceed those prescribed in 40 (U.S.C. 318c), as will ensure their enforcement, for the protection of persons, property, buildings, and grounds of the Arboretum, Washington, D. C., the U.S. Meat Animal Research Center, Clay Center, Nebraska, the Agricultural Research Center, Beltsville, Maryland, and the Animal Disease Center, Plum Island, New York, over which the United States has exclusive or concurrent criminal jurisdiction, in accordance with the limitations and requirements of the Federal Property and Administrative Services Act of 1949 (63 Stat. 377) as amended, the Act of June 1, 1948 (62 Stat. 181), as amended, and policies, procedures and controls prescribed by the General Services Administration. Any rules or regulations promulgated under this authority shall be approved by the Director of the Office of Operations and Finance and the General Counsel prior to issuance.

59. Controls within the Department of Agriculture of the acquisition, use and disposal of material and equipment which may be a source of ionizing radiation hazard.

60. Administers teaching funds authorized under section 22 of the Bankhead Jones Act, as amended (7 U.S.C. 329).

61. Administers science and education programs assigned under the Defense Production Act of 1950, as amended (50 U.S.C. App. 2061 et seq.), and the Federal Civil Defense Act of 1950, as amended (50 U.S.C. App. 2251 et seq.).

40 01 01 0101 F

B. Availability of Information

For further information related to the Science and Education Administration, write to the Information Staff, Science and Education Administration, Washington, D. C. 20250.

C. Regulations

Regulations which relate to certain aspects of SEA programs may be found in Title 7, Code of Federal Regulations, Parts 18 and 500 through 510, and Title 9, Code of Federal Regulations, Parts 445 through 447.

40 01 01 0102 Equal Opportunity Staff

A. Assignment of Functions

1. Provides overall staff assistance to the Director, Science and Education, all units of SEA, and all cooperators in the food and agricultural sciences system to ensure that programs and activities are planned and conducted to ensure equality of opportunity for all persons. Formulates policies, and provides policy direction and technical guidance for a comprehensive equal opportunity program. These activities relate to the following areas:

   — Identifies conditions, actions, or patterns of behavior which might restrict equality of opportunity. Works with SEA managers and cooperators to change these conditions, actions, or patterns.

   — Gives leadership to strengthen the full range of SEA programs, especially expanding the equality of opportunity for participation of all people in the Extension programs.

   — Assists in the development of policies, practices, and procedures which help all employees achieve equality of opportunity to achieve their highest potential of productivity at work. Assists SEA and cooperator personnel staffs to strengthen employment and personnel practices to help achieve this equality of opportunity.

   — Conducts compliance reviews. As appropriate, corrects the conditions of noncompliance, assists in developing conditions for continued compliance, and helps managers of SEA and cooperators obtain assistance in their equal opportunity efforts.

   — Develops and administers a SEA system to determine, for the Director, Science and Education, if a major policy action has a significant civil rights impact. Reviews Civil Rights Impact statements and recommends action to the Director, Science and Education. Assists managers in the preparation of these statements.

   — Participates in joint program reviews coordinated by the Assistant Director, Program Planning, Assessment and Coordination.

40 01 01 0103 Legislative Staff

A. Assignment of Functions

1. Provides staff assistance to the Director, Science and Education, and other key agency officials, principally in the following areas:

   — Legislative programs: including development of proposed legislation to meet the needs of SEA programs; preparation of reports to Congressional committees and Members of Congress, OMB, and the Department concerned with the Agency views on pending legislation; liaison with other Departments and agencies on legislative matters affecting SEA activities and maintenance of historical legislative reference data related to SEA activities. Provides advice and counsel in working with the Congress.

   — Secretary's memoranda: including reviews of numbered and unnumbered memoranda to identify and ensure Agency compliance.

   — Develops and operates a system to keep Agency officials informed about national and international events and developments which affect SEA programs and activities, including Federal Register items.

2. Assures that SEA legislative activities are coordinated with the USDA Office of Governmental and Public Affairs.

40 01 01 0110 Information Staff

A. Assignment of Functions

1. Participates with the Director, Science and Education, and other SEA executives in planning and developing a SEA information program responsive to public and program needs in research, extension, and teaching. Provides policy guidance and direction to the four Regional Information Offices in Agricultural Research.

Current Information

2. Develops SEA policies and provides policy direction and technical guidance concerning the conduct of current information activities including: press and media information, speeches, memorial lectures, newsletters and agency periodicals, radio and television presentations, motion pictures, art and graphic materials, and photographic services.

   — Provides leadership and staff support for the preparation, clearance, and release of press and media information from SEA headquarters units. Provides overall editorial control and coordination for the release of press information by SEA field units. Maintains liaison with national magazines and science writers, cooperating in the development of material to promote the utilization of science and education information.

   — Provides staff assistance in the preparation of speeches, statements, testimony and other special presentations for the Director, Science and Education, and other SEA and Department officials.

   — Plans and coordinates a SEA memorial lecture series conducted in cooperation with major national organizations concerned with public issues.

   — Plans and produces SEA periodicals and the Director's Newsletter.

   — Plans and produces radio and television material reporting science and education information.

   — Provides staff support to SEA managers for the production of exhibits, motion pictures, and art, graphic, and other visual materials.

   — Provides photographic support services to SEA managers.

Publications

3. Develops SEA policy on the publication and distribution of technical information in the food and agricultural sciences. Cooperates with

11-864 O - 83 - 6

Federal Departments and agencies, the States, colleges and universities, other science and education organizations, and user groups in developing the missions, goals, and objectives of SEA's technical information program.

— Coordinates SEA publications planning to determine the need for publications and develop publishing priorities.

— Coordinates or conducts the writing, editing, printing, storage, and distribution of all SEA technical and popular publications except the editing of scientific manuscripts for publication in non-USDA media.

— Develops, maintains, and conducts programs and systems to assure the effective distribution of food and agricultural research and extension publications to farmers, processors, handlers, consumers, and other users.

— Responds to requests for technical and practical information.

— Is responsible for ensuring that SEA's technical information program is integrated into the full spectrum of other Federal activities conducted by SEA and is consistent with the goals and objectives set by joint planning efforts of SEA and cooperators.

Freedom of Information and Privacy Acts

4. Provides advice and guidance to agency officials on the application of policies and procedures to comply with the provisions of the Freedom of Information Act and Privacy Act.

Coordination

5. Assures that SEA information production and dissemination activities are coordinated with the USDA Office of Governmental and Public Affairs.

40 01 02 0201 Deputy Director -- Joint Planning and Evaluation

A. Assignment of Functions

1. Participates with the Director, Science and Education, and other SEA executives in developing Agency policies and programs to insure that SEA:

   -- Supports food and agricultural research, extension, and teaching efforts responsive to local, State, regional, and national needs.

   -- Promotes improved coordination and joint planning of food and agricultural research, extension, and teaching efforts among Federal Departments and agencies, the States, State agricultural experiment stations, colleges and universities, other science and education organizations, and user groups.

   -- Promotes and supports the identification of high priority national objectives in the food and agricultural sciences and initiates special projects to meet those objectives.

   -- Supports programs and activities responsive to world food and agricultural needs.

   -- Builds on present partnership and cooperative arrangements and develops with all performers and supporters of food and agricultural research, extension, and teaching activities, whatever their source of funding, improved cooperation and coordination in the planning and execution of such programs and activities.

   -- Assures that the results of food and agricultural research are effectively communicated and demonstrated to farmers, processors, handlers, consumers, and other users.

   -- Supports and promotes information systems and libraries in the food and agricultural sciences and encourages their effective use in research, extension, and teaching programs.

2. Serves as Executive Director for the Users Advisory Board and the Joint Council.

   -- Insures that staff assistance for the Users Advisory Board and Joint Council is provided from JPE staffs and acts as liaison in obtaining any additional staff assistance needed from other Federal and non-Federal sources as appropriate.

   -- Acts as liaison in obtaining additional staff assistance for the Users Advisory Board and Joint Council from SEA planning and evaluation staffs and other Federal and non-Federal sources as appropriate.

   -- Provides staff assistance and liaison for advisory committees to the Secretary of Agriculture concerning research, extension, and teaching programs as requested by the Director, Science and Education.

3. Provides national leadership and direction for planning, assessment, and coordination of food and agricultural research, extension, and teaching activities.

4. Promotes the integration of administrative management support in SEA planning.

5. Provides leadership for interagency and USDA work groups for planning and coordinating activities.

6. Participates and cooperates with special program managers in addressing high priority programs of national importance.

40 01 02 0201 3

40 01 02 0205 Current and Future Priorities Staff

A. Assignment of Functions

1. Projects and predicts future needs, issues, and trends as a basis for planning the food and agricultural sciences.

2. Cooperates with Federal Departments and agencies, the States, colleges and universities, other science and education organizations, and user groups (espacially the Users Advisory Board and Joint Council) in identifying high priority research, extension, and teaching programs responsive to local, State, regional, national, and world needs.

3. Provides primary staff assistance and staff support for the Joint Council on Food and Agricultural Sciences and the National Agricultural Research and Extension Users Advisory Board. Assist the Executive Director and the Executive Secretaries of these bodies in determining other staff support required.

4. Develop written support statements which summarize social, economic, and physical conditions and other events that influence current and future science and education program priorities, taking into account an appropriate national balance among competing programs and benefit-cost considerations.

5. Participates in setting priorities for research, extension, and teaching programs consistent with current and future demands and Departmental objectives.

6. Works closely with the Program Planning Staff in the development of national program plans to meet research, extension, higher education, and technical information priorities with major emphasis on long range planning.

7. Together with the Evaluation and Impact Staff, reviews proposed Agency budget requests and allocation of funds by program and activity (mission).

8. Publishes annually, at the initiation of Agency budget development, the Agency's priorities for future programs.

9. Participates with SEA managers in the development of criteria for technical information systems that are used in program planning (e.g., CRIS, EMIS, PARIS).

40 01 02 0210 Program Planning Staff

A. Assignment of Functions

1. Articulates, develops, and keeps updated national research and education programs and plans consistent with the goals and objectives of the Agency and cooperating institutions to meet the needs of the users of research and extension programs.

2. Insures the planning and coordination of effective joint programs to meet the needs of Federal agencies, the States, colleges and universities, other science and education organizations, and the users of agricultural research, extension, and education.

3. Integrates programs and program planning with budget development, facility planning, manpower and personnel ceiling planning, and planning and management systems and structures.

4. Has primary responsibility for preparation and justification of the Agency budget to insure the availability of human, financial, and physical resources to carry out high-priority research, extension, and educational programs and projects.

5. Coordinates the development of unified program structures and planning systems to meet the needs of the Department, Agency, and Cooperators.

6. Working closely with staff scientists and specialists in SEA, assesses progress toward meeting program goals and objectives and recommends needed adjustments in resources, procedures, and policies; conducts or participates on a selective basis in program workshops and reviews that cut across the functions and disciplines of SEA or that involve several agencies or organizational groups.

7. Forms, coordinates, and catalyzes teams of scientists and specialists from the various program units of SEA and Cooperators to analyze and assess programs and activities that are multi-functional or inter-disciplinary in nature; insures balance and objectivity in the resulting reports, recommendations, and budgets that go to managers and other agencies and groups.

8. As needed, meets with, serves on, or provides assistance to Departmental and interagency committees, commodity organizations, public at large and other groups which are multi-functional or cross-cutting in nature.

9. Working with others in SEA, insures continuing and systematic liaison with Action and Regulatory agencies.

10. Working with others in SEA, insures continuing and systematic liaison with action and regulatory and other science and technology agencies.

11. Provides staff support as required to the Joint Council and Users Advisory Board.

12. Working with others in SEA, provides liaison with Departmental, OMB, Congressional, GAO, and other staffs.

13. Working with the Legislative Staff, and with assistance from other staffs, handles and coordinates Secretarial and Congressional correspondence and preparation of testimony for Congressional hearings.

14. Reviews and prepares or coordinates the preparation of environmental assessments and impact statements.

15. Provides reports, position papers, special analyses, and other assistance as requested by the Director's office and other SEA managers.

40 01 02 0215 Evaluation and Impact Staff

A. Assignment of Functions

1. Assesses economic, social, technological, and other impacts of Federal and non-Federal research, extension, and teaching including past, current, and future programs.

2. Conducts or coordinates SEA program and management reviews, except those which are the responsibility of the Program Planning Staff.

   — Conducts, coordinates, or participates in special, in-depth reviews at the request of the Joint Council, Users Advisory Board, or others, as appropriate.

   — Participates, on a selective basis, in program reviews conducted or coordinated by the Program Planning Staff or the SEA Units.

   — Develops and maintains a current record and plans for all SEA program reviews, based on information provided by the Program Planning Staff and the SEA Units.

   — Brings findings of SEA program reviews to the attention of appropriate administrators and advisory groups with recommended actions.

   — Monitors and evaluates SEA program review procedures and reports, including the progress of followup activities for reviews.

   — Assesses and recommends improved program review methodologies.

3. Submits an annual evaluation of SEA programs and activities.

4. Together with the Current and Future Priorities Staff, reviews proposed Agency requests and allocation of funds by program and activity (mission).

5. Participates with SEA managers and especially TIS in the development of criteria for technical information systems that are used in program planning (e.g., CRIS, EMIS, PARIS).

6. Arranges and conducts or coordinates technology assessment studies; analyzes and summarizes relevant technology assessment studies conducted by other organizations — keeps SEA managers informed of the results and conclusions of such studies.

7. Forms special or continuing multidisciplinary and multifunctional review and evaluation teams, involving staff scientists and specialists of the program units of SEA; chairs such teams as appropriate.

8. Conducts or participates in special reviews and assignments as requested by the Director's Office.

40 01 03 0301 Deputy Director -- Administrative Management

A. Assignment of Functions

1. Participates with the Director, Science and Education, and other SEA executives in developing Agency policies and programs to insure that SEA:

   -- Supports food and agricultural research, extension, and teaching efforts response to local, State, regional, and national needs.

   -- Promotes improved coordination and joint planning of food and agricultural research, extension, and teaching efforts among Federal Departments and agencies, the States, colleges and universities, other science and education organizations, and user groups.

   -- Promotes and supports the identification of high priority national objectives in the food and agricultural sciences and initiates special projects to meet those objectives.

   -- Supports programs and activities responsive to world food and agricultural needs.

   -- Builds on present partnership and cooperative arrangements and develops with all performers and supporters of food and agricultural research, extension, and teaching activities, whatever their source of funding, improved cooperation and coordination in the planning and execution of such programs and activities.

   -- Assures that the results of food and agricultural research are effectively communicated and demonstrated to farmers, processors, handlers, consumers, and other users.

   -- Supports and promotes information systems and libraries in the food and agricultural sciences and encourages their effective use in research, extension, and teaching programs.

2. Provides national leadership for collaborative efforts and joint planning in administrative management among all performers and supporters of food and agricultural research, extension, and teaching including personnel administration, contracts and agreements, financial management, data processing, and other functions of mutual concern.

3. Provides leadership, formulates and coordinates the policies and administrative management services to meet the needs of SEA program operations and cooperative efforts.

4. Assures the implementation of national, departmental, and SEA administrative management policies, program goals, and objectives.

5. Provides guidance to the administrative management services in the activity units.

40 01 03 0303 Organization and Management Development Staff

A. Assignment of Functions

1. Provides staff assistance to the Director, Science and Education, and other key officials of SEA in the formulation of policies and programs to increase the organizational and managerial effectiveness of the food and agricultural sciences systems.

2. Provides organization and management consulting services to SEA officials including reviews and analyses of work units, systems, technologies, roles, and functions. In working with SEA managers, provides counsel, advice, and support in areas of problem definition and development and application of alternative organization and management theories, techniques, and approaches.

3. Participates with SEA officials in developing and conducting organizational effectiveness and human systems development programs and activities including applied organization research, team building and intergroup activities, and other activities and approaches which take into account human dynamics.

4. Coordinates policies to promote the management improvement program in SEA.

5. Participates with SEA officials in the design and development of organization structures. Analyzes and evaluates organizational proposals. Prepares and recommends approval of documents essential to the implementation of organization decisions.

6. Facilitates development and application of a comprehensive program of management development through collaboration with other SEA units responsible for the acquisition, retention, and use of managerial skills and techniques. As appropriate, designs and conducts management development activities which support the organizational effectiveness of SEA. In collaboration with cooperators, facilitates the acquisition and development of organization and management skills, techniques, and knowledges in the food and agricultural sciences system.

7. Provides coordination for the collaborative technical assistance activities between the administrative management staffs of SEA and cooperators to maximize the use of their knowledge, skills, or experience throughout the entire food and agricultural sciences system. Such coordination includes, but is not limited to, identifying opportunities, designing processes, and promoting improvements in operation throughout the entire food and agricultural sciences system.

40 01 03 0304 Budget Division

A. Assignment of Functions

1. Develops SEA budget planning, development, presentation, execution, and reporting policies and procedures.

2. Develops, prescribes, and aproves budgetary processes employed by subunits of SEA and assures effective integration of budget activities within SEA.

3. Provides staff assistance to SEA planning and evaluation staffs and program and line managers regarding resource requirements of programs.

4. Develops the SEA component of the Department's Zero Base Budget and multi-year Program and Financial Plan.

5. Reviews materials prepared for all budgetary planning purposes and prepares presentations of the budget activities of SEA. Participates in the presentation of budget estimates and requests before the Department, OMB, and Congress. Prepares and coordinates all material for insertion in the Appropriations Hearings, and initiates for initiation of necessary revisions or additions to the language, schedules, and justifications as contained in the budget, explanatory notes to Congress, and Congressional bills. Prepares special reports and explanations for use by the Director, Science and Education, and the Office of the Secretary for budget purposes. Determines the availability of funds including reimbursable and trust funds, for program and administrative requirements, recommends use of all discretionary funds, and analyzes, evaluates, and recommends for approval by the Director, Science and Education, allotments and apportionments to assure compliance with approved budget decisions, programs, congressional intent, and applicable laws and regulations. Evaluates and recommends allotment adjustments or transfers between programs. Effects allotments, apportionments, adjustments, and transfers for all funds appropriated to SEA.

6. Prepares Obligations by Activities Schedule and necessary revisions thereof, based upon Appropriation Act and determinations by the Appropriations Committees and the Director, Science and Education, for submission to the Department.

7. Prepares, reviews, and coordinates all special in-depth budget reports and material for use by the Director, Science and Education, and his staff, and the Department in responding to requests from committees and members of Congress, other Federal and State agencies, and other organizations.

8. Prepares or reviews budgetary correspondence relating to research, extension, and teaching activities for the Director, Science and Education, and the Office of the Secretary of Agriculture. Reviews such similar correspondence prepared by other SEA offices for accuracy, effectiveness, and compliance with SEA and Departmental budget policies.

40 01 03 0305 Personnel Division

A. Assignment of Functions

1. Formulates policies and provides policy direction and technical guidance for a personnel management program in SEA. The personnel program relates to the following functional areas:

   -- Classification and Pay: including position classification, classification standards, classification appeals, position management, research grade evaluation, and wage and salary administration.

   -- Employment and Placement: including recruitment, examining, equal employment opportunity, leave administration, personnel security, qualification standards, employee benefits, and health benefits.

   -- Labor Relations: including labor-management relations, employee relations and services, employee conduct, fitness, performance and suitability, employee appeals, performance evaluation, and incentive awards.

   -- Training and Career Development: including general skill training, educational programs, upward mobility, and fellowship and/or scholarship awards.

2. Provides national leadership for collaborative efforts and joint planning in personnel management among all performers and supporters of food and agricultural research, extension, and teaching.

3. Provides centralized Agency administrative support for classification and other employee appeals, discrimination complaints, labor-management relations, examinations, acceptance of educational awards, and prior approvals of personnel actions.

4. Supports the professional and technical development of SEA and cooperator personnel performing personnel administration and management functions through activities like training, coaching, and limited duration assignments.

5. Evaluates the effectiveness of the administration of personnel policies and procedures by participating in joint reviews and conducting personnel management evaluations coordinated with the Evaluation and Impact Staff. Modifies policies and procedures or, as appropriate, facilitates changes.

6. In collaboration with the Program Planning Staffs, develops and maintains a system to acquire, compile, analyze, and report SEA manpower data. Participates in the development of strategies to meet current and long-range manpower needs.

7. Develops and conducts executive and management training and development programs and activities which facilitate the acquisition, retention, and use of skills, techniques, and knowledges required by all levels of SEA managers.

8. Conducts research nd special studies of the personnel management systems of the Agency and provides leadership for experimental aplications of research results which show promise of bringing about improvements in personnel management. Assesses the changes caused by the introduction of new personnel management policies, practices, or procedures.

40 01 03 0310 Financial Management Division

A. Assignment of Functions

1. Formulates policies and provides policy direction and technical guidance for a financial management program in SEA. Financial management relates to the following functional areas:

   -- Systems and Procedures: including developing the Agency accounting system, issuing procedures and instructions concerning fiscal and accounting operations, developing an integrated financial management system, reviewing financial management systems for weaknesses.

   -- Financial Analysis and Control: including developing and recommending policies relating to fiscal control of Agency funds, maintaining an accounting system for Agency funds, preparing, reviewing, and distributing Agency financial reports issued to its managers, the Department and other Federal agencies, and analyzing financial reports to assure efficient and balanced expenditures.

2. Provides national leadership for collaborative efforts and joint planning in financial management among all performers and supporters of food and agricultural research, extension, and teaching.

3. Provides centralized Agency administrative support for maintenance of the accounting system, financial reports to SEA managers, USDA, and other Federal agencies, and followup action on audit reports relating to fiscal management.

4. Supports the professional and technical development of SEA and cooperator personnel performing financial management functions through activities like training, coaching, and limited duration assignments.

5. Evaluates the effectiveness of the administration of financial management policies and procedures by participating in joint review and conducts mutual assistance reviews coordinated with the Evaluation and Impact Staff. Modifies policies and procedures or, as appropriate, facilitates changes.

40 01 03 0315 Administrative Services Division

A. Assignment of Functions

1. Formulates policies and provides policy direction and technical guidance for an administrative services program in SEA. The administrative services program relates to the following functional areas:

— Acquisition and Supply Management: including procurement and contracting for equipment, including ADP, construction, supplies, materials, professional and other services; control, receipt, and distribution of stores' stocks required for program operations (OMB Circular A-76) and major systems acquisitions (OMB Circular A-109).

— Real Property and Space Management: including the acquisition, disposition, utilization, planning and development, design and construction, control and accountability, security, alteration, rehabilitation, inspection, maintenance, and repair of buildings and facilities; acquisition, disposition, and utilization of land; application of energy conservation measures; application of water and air pollution control measures for agency installations; fire protection; cost estimates and programming for project planning purposes; engineering and construction project management; emergency contingency planning.

— Personal Property Management: including the acquisition, disposition, utilization, replacement, storage, control, and accountability, security, inspection, and maintenance and repair of personal property, including motor vehicle equipment and the application of energy conservation measures.

— Program Agreements Management: including SEA research contracts, grants, cooperative agreements, and memoranda of understanding. Includes selection, negotiation, implementation, and administration of program agreements including review for compliance with laws, regulations, policies, procedures, and adequacy of description of work to be performed and proper administration during term of the agreements.

— Patent Management: Patenting of inventions of SEA employees and employees of contractors, grantees, and cooperators, including appropriate publication of such patents as required.

— Safety and Health Program Management: including development or adoption of modern safety and health policies and procedures; conducting reviews and inspections to ensure safety and health compliance; developing and conducting occupational training, educational and promotional programs in accident, injury, and illness prevention; conducting environmental monitoring and epidemiological studies to maintain employees' health; advising SEA management on safety and health matters pertaining to facility construction, repair and maintenance, equipment purchases, and general program administration; evaluation of documents, reports, and statistics generated by occupational injuries, illness, property damage, health maintenance program results, medical treatment, compensation and tort claims; providing safety and health leadership, coordination, technical consultation, and liaison with USDA, other Federal agencies, private industries, and SEA field and headquarters program, management, staff, and support entities.

— Records Management and Analysis: including the development and employment of effective methods to control the generation, utilization, and disposition of SEA reports, correspondence, directives, Federal Register documents, copying and reproduction, mail, forms, and files of records on paper, photographic, magnetic, microfilm, audiovisual, and all other media.

2. Provides national leadership for collaborative efforts and joint planning in administrative services program activities among all performers and supporters of food and agricultural research, extension, and teaching.

3. Provides centralized agency administrative support in the following areas: real property acquisition and disposal; transfer of agency historical records to the National Archives; forms analysis and design; security of defense classified materials; studies of agency-wide paperwork management systems; OMB clearance of public reporting and recordkeeping requirements; agency procurement contracts and program agreements for nationwide use; and field contracting and technical assistance on major systems acquisitions.

4. Supports the professional and technical development of SEA and cooperator personnel performing administrative services functions through activities like training, coaching, and limited duration assignments.

5. Evaluates the effectiveness of administrative services policies, programs, and procedures by participating in joint program reviews and conducts mutual assistance reviews coordinated with the Evaluation and Impact Staff. Modifies policies, programs, and procedures or as appropriate, facilitates changes.

6. Conducts a program of patent licensing for all USDA patents including advertising and other promotional activities designed to promote further technological development by the public using USDA inventions.

40 01 03 0320 Communications and Data Services Division

A. Assignment of Functions

1. Formulates policies and provides policy direction, technical planning, and procedural guidance throughout SEA for the acquisition and utilization of communications and automatic data processing systems and services. Determines best source of ADP Services to support each SEA program need and provides in-house services when appropriate. The communications and data services program encompasses the following functional areas:

— Communications Technology: including technical assistance, review, and approval of communications technology utilization in the areas of telecommunications, FTS voice/data transmission management and ADP security, facsimile transmission, radio frequency assignments, word processing, text editing, and automated office design.

— ADP Equipment Acquisition and Use: including technical assistance, review and approval of appropriate analyses, feasibility studies, specification statements, or other documentation for requests to obtain outside data processing hardware and/or services as well as the maintenance of appropriate records for reporting purposes.

— Management ADP Systems: including feasibility studies, analysis, design, software development, implementation and continued maintenance and production, outside contracting, contracting administration in cooperation with SEA administrative program managers; continued evaluation of existing systems with regard to improved performance and current technology; and development of functional specifications for the acquisition of hardware and/or software systems in support of SEA management program coordinators.

— ADP User Services: including training, standards, data base administration, operational procedures, teleprocessing, systems software maintenance, technical user assistance, data conversion, technological assessment (graphics, high level languages, statistical and simulation packages and techniques), vendor interface, and data processing through use of SEA, Departmental, University, and commercial ADP equipment; assists in review of ADP technical specifications; coordinates production efforts of scientific and information systems program coordinators.

11-864 O - 83 - 7

-- ADP Support or Scientific Data Management: including feasibility studies; computer systems design and development assistance in general and interactive scientific ADP applications; and technical assistance in the specification and acquisition of scientific ADP hardware and software systems in cooperation with and in support of SEA scientific and information systems program coordinators.

-- Mini-Computer Technology: including support for management and laboratory mini-computer systems in terms of requirements analysis, feasibility studies, functional/technical specifications, technical support to the contracting officer, acceptance testing, development of systems and application software, development of specialized electronic interface hardware, and ..sistance in the efficient collection of laboratory and field experimental data.

2. Provides central liaison services between SEA and outside agencies for all communications, data processing, and related activities.

3. Supports the professional and technical development of SEA and cooperator personnel performing communication and data management functions through activities like training, coaching, and limited duration assignments. Represents SEA management as the ADP technical expert relating to ADP systems.

4. Evaluates the effectiveness of the administration of communication and data management policies an procedures by participating in joint program reviews and conducts mutual assistance reviews coordinated with the Evaluation and Impact Staff. Modifies policies and procedures or, as appropriate, facilitates changes.

40 01 03 0340 Grants Administrative Management Office

A. Assignment of Functions

1. Provides leadership, guidance, and direction for administrative management and process servicing of competitive extramural programs within the Science and Education Administration. Responsibilities include:

— establishing operating administrative management policies and procedures regarding solicitation, negotiation, execution, and administration of competitive program grants, contracts, and cooperative agreements;

— managing administrative management activities concerned with (a) proposal solicitation, preselection review and preaward negotiation, (b) clearances and compliance with mandatory Federal and Agency programs and policies, and (c) execution and post-award administration;

— participating with SEA program managers on administrative matters relating to competitive program decisions and planning;

— establishing and maintaining a close working association with educational institutions, hospitals, and nonprofit organizations, State and local governments, Federal agencies, and other research or mission-oriented organizations, both profit and nonprofit, on administrative management aspects of competitive extramural programs, including educating and advising on Agency policies and procedures.

40 01 03 0360 Administrative Operations Division

A. Assignment of Functions

1. Provides operational administrative management leadership, advice, and services to SEA Headquarters, AR-NER, and Human Nutrition units in northeastern region of AR to facilitate their mission of conducting and supporting research, extension, and teaching programs in the food and agricultural sciences.

   — Provides personnel management leadership, advice, and services for employment, placement, classification, and pay.

   — Provides financial management leadership, advice, and services for funding levels and priorities, operating budgets, financial plans, resource and position management, and fund control and accounting.

   — Provides general services leadership, advice, and support for supply, procurement, contracting, personal property, safety, engineering design, real property, paperwork management, printing, duplicating, distribution services, mail, and shuttle services.

   — Provides leadership and guidance to field personnel who perform administrative management functions at field locations in the Northeastern Region of Agricultural Research, and Human Nutrition field units in northeastern region of AR.

40 04 04 0401 Assistant Director - Special Programs

A. Assignment of Functions

1. International Activities

a. Administers the international programs of SEA in research and extension.

b. Administers the Special Foreign Currency Research program for USDA.

c. Promotes cooperation and provides coordination for SEA programs with international organizations, arranging for SEA specialists to serve on U.S. delegations to international meetings, participating on panels of experts, and exchanging technical information and research and educational materials.

d. Guides participation of SEA in Bilateral Science Agreements including evaluation of proposals for such agreements and arrangements for SEA specialists to participate.

e. Cooperates with the Agency for International Development by arranging for SEA to (1) furnish technical expertise and consultation, (2) train and guide foreign food, agricultural, and nutrition specialists, and (3) cooperate in Participating Agency Service Agreements.

f. Maintains liaison and cooperates with the Office of International Cooperation and Development (OICD) USDA.

2. Special Program and Project Management

a. Participates with the Director, S&E in the identification and selection of high priority programs and projects which require program or project management, or special coordination. Examples of special programs are Agricultural Energy, Natural Resources, Aquaculture, and Pesticide Impact Assessment.

b. In collaboration with other SEA managers and cooperators, develops methods and procedures to insure effective coordination and management of selected high priority programs and projects.

c. Directs and supervises SEA's Special Program and Project Managers, provides for the professional development of program and project managers, especially with respect to the acquisition and development of skills, techniques, and experience necessary to function effectively as a program or project manager.

d. Ensures that program management activities are integrated into the full spectrum of other Federal activities being conducted by SEA and are consistent with the goals and objectives set by joint planning efforts of SEA and cooperators.

40 05 05 0501 Administrator - Extension

A. Assignment of Functions

1. Provides for the administration of Acts of Congress that authorize Federal appropriations for extension activities carried on by Land Grant Colleges, and State and county extension offices in 50 states, Puerto Rico, Guam, the Virgin Islands, and the District of Columbia.

2. Provides program leadership and assistance to the States in the conduct of extension programs in agricultural production, marketing, natural resources, family education, food and nutrition, 4-H youth development, community and rural development.

3. Conducts innovative and special programs and projects to meet identified and high priority educational needs.

4. Promotes coordination and conducts a continuing system of comprehensive technical assistance to cooperative extension programs to maintain the effectiveness of extension efforts at the local, State, regional, and national levels.

5. Participates and cooperates with Special Program and Project Managers in addressing high priority programs of national importance that, due to their nature, require special coordination and management.

6. Encourages continuing efforts to improve the coordination of research, extension, and teaching in the food and agricultural sciences among all Federal and non-Federal cooperators.

7. Serves as the educational arm of the USDA by providing for liaison and the development and coordination of cooperative working relationships between the State Extension system and other USDA agencies, as well as between the Extension system and other Federal Departments and organizations.

8. Coordinates, evaluates, and provides liaison for the activities of other SEA units in support of the Cooperative Extension system, including areas such as civil rights, information, legislation, program planning, personnel, budget, financial management and general services.

40 06 06 0601 Administrator - Cooperative Research

A. Assignment of Functions

1. Administers a nationwide system of research program planning and coordination between the States and the U. S. Department of Agriculture related to the food and agriculture sciences, in their broadest aspects.

2. Provides for the administration of Acts of Congress that authorize Federal appropriations for agricultural research carried on by the State Agricultural experiment stations of the 50 states, Puerto Rico, Guam, the Virgin Islands, and the District of Columbia; by schools of forestry, the 1890 land grant institutions and Tuskegee Institute and other eligible institutions. Represents SEA in a primary liaison role with the lead research administrators in the institutions that participate in the programs listed above.

3. Responsible for lead interaction with all organizational groups (ESCOP, Committee of Nine, ASCUFRO, Association of Research Directors, etc.,) related to the programs administered by Cooperative Research.

4. Administers a Competitive Research Grants program to provide special emphasis on basic research critical to enhancing food production and to improving human nutrition.

5. Provides for a continuing system of comprehensive reviews to provide assistance in maintaining the effectiveness and quality of cooperative research.

6. Participates and cooperates with Special Program and Project Managers in addressing high priority programs of national importance that, due to their nature, require special coordination and management.

7. Encourages continuing efforts to improve the coordination of research, extension, and teaching in the food and agricultural sciences among all Federal and non-Federal cooperators.

8. Administers a Special Grants Program designed to approach specific problem areas in Agricultural and Forestry Research.

9. Administers multi-institution research programs on behalf of SEA with funds appropriated to other Agencies in the Department and in Federal Government [i.e., Dept. of Energy, EPA, AID, Forest Service, etc.].

40 07 07 0701 Administrator — Agricultural Research

A. Assignment of Functions

1. Administers a comprehensive and nationally coordinated Federal program of basic, applied, and developmental research in (a) animal production, (b) plant production, (c) use and improvement of soil, water, and air, and (d) processing, storage, distribution, and food quality and safety.

2. Provides for the proper utilization and development of scientific, technical, and other personnel, as well as facilities, equipment, and other physical resources to insure that research needs in the food and agricultural sciences are met in an efficient and effective manner.

3. Participates and cooperates with Special Program and Project Managers in addressing high priority programs of national importance that, due to their nature, require special coordination and management.

4. Encourages continuing efforts to impove the coordination of research, extension, and teaching in the food and agricultural sciences among all Federal and non-Federal cooperators.

40 07 (10-70) Agricultural Research Regional Offices

A. Assignment of Functions

1. Participates with the Administrator - Agricultural Research in the planning and developing of national research programs.

2. Administers and manages research projects of the national research programs assigned to their regions.

3. Cooperates with the State Agricultural Experiment Station and other Federal and State agencies to facilitate effective coordination in the conduct of regional research programs.

B. Availability of Information

Information concerning SEA Agricultural Research programs may be obtained from the following offices:

Northeastern Regional Office, Beltsville Agricultural Research Center, Beltsville, MD 20705.

Northcentral Regional Office, 2000 West Pioneer Parkway, Peoria, IL 61614.

Southern Regional Office, P. O. Box 53326, 701 Loyola Avenue, New Orleans, LA 70153.

Western Regional Office, 1333 Broadway Suite 400, Oakland, CA 94612.

40 08 08 0801 Administrator — Technical Information Systems

A. Assignment of Functions

1. Provides for the continuing development of comprehensive and coordinated technical information, and library systems and services for the food and agricultural sciences.

2. Directs and conducts extensive library and technical information systems and services including:

Library Services

— Develops and recommends policies concerning USDA library needs and services.

— Identifies, acquires, catalogues, and maintains a permanent worldwide collection of books and journals involving the food and agricultural sciences and related USDA needs.

— Collects, catalogues, and maintains a complete inventory of USDA-authored publications.

— Provides library services, including bibliographic references, loans, and reprints to USDA personnel, other libraries, research and extension professionals (domestic and foreign), and the general public, as appropriate.

— Promotes cooperation among USDA agencies, land-grant institutions, and colleges and universities in the provision of library services including the development of library networks.

Food and Nutrition Information

— Assembles and collects food and nutrition education materials, including the results of nutrition research, training methods, procedures, and related materials.

— Maintains such information and materials in a library.

— Provides for the dissemination of such information.

Information Systems

Promotes the effective dissemination of information concerning research, extension, and teaching efforts and results to scientific and professional personnel and other users by developing, maintaining, coordinating, and promoting the effective utilization of information systems,

such as:

— Indexes of citations for current food and agricultural science and education publications (AGRICOLA).

— Indexes of citations from all USDA-authored publications.

— A continuing inventory of ongoing and completed research projects (CRIS).

— A compilation of solar energy research projects related to agriculture which are being carried out by Federal, State, private, and nonprofit institutions and, where available, the results of such projects.

— A system for documenting and reporting the level of effort devoted to a variety of extension efforts by Federal and State extension professionals (EMIS).

— A system for documenting and reporting the Federal research resources being utilized for specific problems, commodities, and disciplines in different geographic areas (PARIS).

— Citations of current scientific publications in specific food, agriculture, and related scientific disciplines to aid scientists in maintaining an awareness of new knowledge in their disciplines (Current Awareness Literature Service).

— Specialized bibliographic files to meet the needs of research, extension, and teaching professionals and organizations.

In collaboration with other SEA managers, staffs, and cooperators, develops methods and procedures to insure effective design and management of these systems to meet the needs of users.

4. Directs specialized information centers, including the Law Library, D. C. Branch Library, Arboretum Library, and Food and Nutrition Information and Education Resources Center.

5. Participates and cooperates with Special Program and Project Managers in addressing high priority programs of national importance that, due to their nature, require special coordination and management.

6. Encourages continuing efforts to improve the coordination of research, extension, and teaching in the food and agricultural sciences among all Federal and non-Federal cooperators.

40 09 09 0901 Assistant Director -- Higher Education

A. Assignment of Functions

1. Provides for the continuing development of a system of comprehensive support for the teaching of the food and agricultural sciences, in their broadest aspects, in all colleges and universities.

2. Provides for the administration of Acts of Congress that authorize Federal appropriations for grants and other funds to support the furtherance of education in the food and agricultural sciences in all colleges and universities, and the establishment or expansion of schools of veterinary medicine.

3. Participates and cooperates with Special Program and Project Managers in addressing high priority programs of national importance that, due to their nature, require special coordination and management.

4. Encourages continuing efforts to improve the coordination of research, extension, and teaching in the food and agricultural sciences among all Federal and non-Federal cooperators.

40 90 90 9001 Administrator - Human Nutrition

A. Assignment of Functions

1. Administers a Federal research program in human nutrition which includes but not limited to: (a) human nutritional requirements; (b) nutrient composition of foods and the effects of agricultural practices, handling, food processing, and cooking on the nutrients they contain; (c) development of methodology for surveillance of the nutritional benefits provided to participants in the food programs administered by the Department of Agriculture; (d) factors affecting food preference and habits; (e) development of techniques and equipment to assist consumers in the home or institutions in selecting food that supplies a nutritionally adequate diet; (f) nutritional and dietary intake assessment surveys to define food usage and consumption in households and institutions; (g) development of educational approaches in the dissemination of nutrition information to users; (h) development of education theory and principles for application to analysis of nutritional behavior as affected by lifestyle, food availability, marketing, human environment, and decision-making factors.

2. Provides leadership for collaborative efforts in human nutrition research, extension, and teaching, both nationally and internationally.

3. Provides technical clearance and assistance in the development of nutrition information dissemination from the Department.

4. Ensures that programs are integrated into the full spectrum of other Federal activities being conducted by SEA and are consistent with the goals and objectives set by joint planning efforts of SEA and cooperators.

5. Interfaces both with SEA's planning and evaluation staffs and with other SEA staffs who are developing related programs for plant and animal breeding; plant and animal production; food processing and distribution; food safety, toxicology, pharmacology, biochemistry, and organic chemistry; and the impact of soil, water, and air resources on nutrients in the agricultural food chain.

5. Participates and cooperates with Special Program and Project Managers in addressing high priority programs of national importance that due to their nature require special coordination and management.

6. Encourages continuing efforts to improve the coordination of research, extension, and teaching in the food and agricultural sciences among all Federal and non-Federal cooperators.

Mr. SCHEUER. Above and beyond the formal written response—after all we spent a lot of taxpayers' money on the three reports—what are you doing with these reports? What lessons have you derived from them and what changes are being made to meet some of the needs that these reports have outlined? Nobody here is trying to criticize USDA, but it seems to me there has been a lot of thoughtful analysis. Without pointing the finger of blame at anybody, these three reports point to some new directions in terms of organization, scope of research, and institutions as a means of defining and setting priorities.

Has anything taken place in your Department under your leadership that would reflect some of these suggestions?

Dr. KINNEY. Yes, sir, Mr. Chairman, I think, as you indicate, the response, the unwritten response is obviously more important.

Mr. SCHEUER. Very much more important.

Dr. KINNEY. As I indicated before, because there have not been budget increases, one of the things that has to take place in the Agricultural Research Service and through CSRS to the experiment stations and our cooperators has been redirection of programs into higher priority areas.

There have been extensive redirections in ARS and I know from experience and contact there have been extensive research redirections at experiment stations.

With respect to the recommendations for changes in structure, yes, we have taken some steps to realine the structures of the organization insofar as possible to better, more effectively address the national priorities.

Mr. SCHEUER. Could you give us any details, any memos, any reports?

Dr. KINNEY. Yes, sir, we can provide some material for the record, Mr. Chairman.

Mr. SCHEUER. That would be very useful.

[The information follows:]

ARS has completed or is implementing research program redirections totaling $12 million. All of these represent on-site shifts of emphasis. None involved relocation of people. Through these efforts, ARS was able to address new researchable problems in the absence of budget increases.

Additional proposed redirections which involve the shift of funds and people from one ARS location to another are under study within the Department.

The most significant realignment was within the ARS National Program Staff. The former arrangement of National Research Program Leaders in four subject matter staffs (Crops, Soils, Livestock and Postharvest) has been replaced with an arrangement of teams guided by two Associate Deputy Administrators. Teams will be created and disbanded to account for changing national leadership needs. An organizational chart portraying the new arrangement is attached.

U. S. DEPARTMENT OF AGRICULTURE

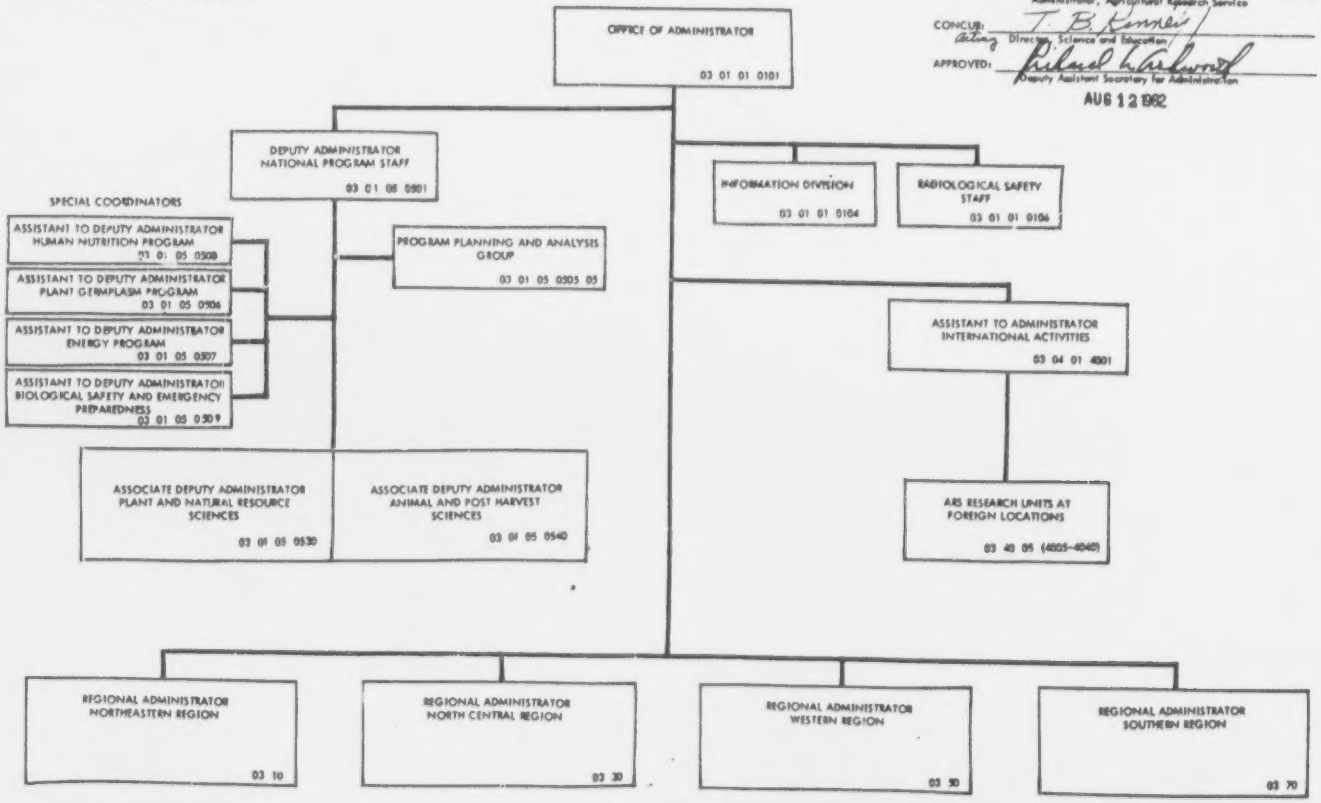
AGRICULTURAL RESEARCH SERVICE

RECOMMENDED: T. B. Kinney
Administrator, Agricultural Research Service

CONCUR: T. B. Kinney
Acting Director, Science and Education

APPROVED: Richard L. Ashworth
Deputy Assistant Secretary for Administration

AUG 12 1982



Supercodes chart dated February 4, 1982

MISSION: Develops through basic, applied, and developmental research, new knowledge and technology which will insure an abundance of high quality nutritious, reasonably priced food and other agricultural products to meet domestic and world needs while maintaining natural resources and environmental quality. This mission focuses on the development of technical information and technical products which bear directly on the needs to (1) manage and use the Nation's soil, water, air, and climate resources and improve the Nation's environment; (2) provide an adequate supply of agricultural products by practices that will maintain a permanent and effective agriculture; (3) improve the nutrition and well-being of the American people; (4) improve living in rural America; (5) strengthen the Nation's balance of payments; and (6) promote world peace.

FOREWORD

This document states the mission of the Agricultural Research Service (ARS) of the U.S. Department of Agriculture (USDA). It also describes the specific scientific activities through which ARS pursues that mission in three contexts.

As one component in the full U.S. agricultural research and development system, ARS carries out research that is critical for maintaining the vitality and productivity of the Nation's food and agricultural industries. There is valid consensus that the current strength and well-being of those industries have resulted from, and will continue to rely on, effective research.

As the research arm of the USDA, ARS responds to the needs of the vast complex of interactive industries that produce, process, and deliver agricultural products to consumers in the United States and around the world. The activities of ARS mirror that complex but are assembled in the agency in a way that efficiently supports the diverse and separate phases of agriculture.

As a Federal system of science laboratories, ARS provides an extensive network of research centers, locations, and work sites. They are strategically located in the geographic areas best suited for the pursuit of research on specific agricultural commodities and on specific problems. Many are near Land-Grant Universities and State experiment stations with whom ARS cooperates. In the ARS organization, research activities are decentralized, but they are centrally managed.

This document highlights some of the special capabilities that ARS has developed to meet the specific needs of agriculture and to solve its specific problems. The many statutes legislated since 1862 that have shaped ARS and to which ARS must respond are summarized in Appendix A.

The Agricultural Research Service, its programs, and its employees reflect the dynamic nature of the complex that is U.S. agriculture. The enviable record of U.S. agriculture is a tribute to the generations of scientists who have contributed to every area of research included in their mission. Specific objectives in that mission have changed during the last 20 years and will continue to change. Overall, however, the sole mission of ARS, the world's largest and most diverse national research organization, is research that responds promptly to the changing needs of U.S. agriculture.

T. B. Kinney

T. B. KINNEY, JR.
Administrator
Agricultural Research Service,
U.S. Department of Agriculture

11-864 O - 83 - 8

CONTENTS

	Page
THE MISSION OF THE AGRICULTURAL RESEARCH SERVICE	1
SPECIAL CAPABILITIES OF THE AGRICULTURAL RESEARCH SERVICE	3
ORGANIZATION AND OPERATION OF THE AGRICULTURAL RESEARCH SERVICE	5
Administrator	5
Deputy Administrator, National Program Staff	5
Regional Administrators	6
ARS FACILITIES	7
Major National and Regional Centers	8
Human Nutrition Research Centers	10
Crop Sciences Facilities	12
Livestock and Veterinary Sciences Facilities	20
Post Harvest Science and Technology Facilities	24
Soil, Water, and Air Sciences Facilities	29
APPENDIX A - PRINCIPAL STATUTES	31
APPENDIX B - AGRICULTURAL RESEARCH SERVICE OFFICES	45
APPENDIX C - MAP SHOWING MAJOR ARS LOCATIONS	47

The Mission of the Agricultural Research Service

The U.S. food and agriculture enterprise produces and provides the food and fiber commodities and products required to meet the needs of the American people and contributes materially to the Nation's international trade.

The scientific and technological advances required by this dynamic enterprise are provided by the full U.S. food and agricultural research and development system. The system is complex, embracing public and private scientific and educational institutions. Those institutions carry out independent but cooperative and complementary research and development activities that are responsive to the needs of the complex food and agriculture enterprise. Private corporations support and conduct research and development designed to produce new commercial products and processes; State agricultural experiment stations, State extension services, and State colleges and universities undertake scientific and educational activities intended primarily to meet the needs of their individual States; and other public and private institutions perform research and development in response to the defined needs of various Federal, State, and private sponsors.

The U.S. Department of Agriculture is authorized by legislation to provide the leadership, oversight, and management necessary to assure that the Nation is provided with adequate supplies of high-quality food and fiber. In fulfilling its responsibilities, the Department supports and conducts a wide range of research, development, extension, and education activities. A major responsibility for assuring that national food and agricultural research needs are being met rests with the Department of Agriculture's research arm--the Agricultural Research Service (ARS).

THE MISSION OF THE AGRICULTURAL RESEARCH SERVICE is to plan, develop, and implement research that is designed to produce the new knowledge and technologies required to assure the continuing vitality of the Nation's food and agriculture enterprise. As a Federal research agency, ARS (1) addresses problems that are of legitimate national concern, (2) conducts research that is appropriate for the Federal Government, and (3) exploits the unique capabilities of ARS scientists and the facilities they operate--a combination that forms an integrated and coordinated national resource that is not duplicated by others in the full U.S. agricultural research and development system.

More specifically, ARS conducts research that is—

1. National in perspective in that it focuses on significant problems affecting the entire Nation or its several broad geographic areas;

2. Sufficiently long range, high risk, and of such broad scope as to require the unified planning, continuity of effort, and stable scientific environment maintained by the Federal research organization;

3. Not undertaken by other agricultural research institutions because of their narrower geographic focus or shorter-term perspective; and

4. Uniquely a Federal responsibility in that it—

   a. Is requested by Congress or the Executive Branch and requires special skills, facilities, or capabilities of ARS;

   b. Requires a structure ready to respond to emergency situations of regional or national significance;

   c. Is international in nature, supporting foreign policy initiatives of the U.S. Government;

   d. Supports the development and maintenance of important national collections that are essential to scientific activities; or

   e. Supports Federal action programs.

2

SPECIAL CAPABILITIES OF THE AGRICULTURAL RESEARCH SERVICE

To accomplish its mission, ARS—

- Operates a complex organization that conducts research to achieve long-range objectives in agriculture, while ensuring dynamic, timely, and flexible responses to new problems and changing national goals;

- Maintains a network of research centers, locations, and worksites in the United States and abroad; and

- Encourages and nourishes a scientific environment that fosters the development of creative, innovative technical expertise.

The following are essential to the ARS mission:

A Centrally Organized Base of Scientific and Agricultural Expertise--The ARS national organization permits the quick formation and operation of multidisciplinary teams to respond to research needs. These teams are centrally coordinated and can be assigned to priority research or analysis of problems without conflicting demands on time or responsibility. The familiarity of ARS scientists with Government programs, action agency needs, and regional and national problems provides a unique overview perspective on the full agricultural research system.

Central Planning, Management, and Coordination--As a major component of the full research and development system, ARS centrally plans, coordinates, and manages diverse research programs that operate in a decentralized mode.

Unique Collections and Repositories--Unique collections and repositories of information and materials, developed and maintained by ARS, are essential in meeting national research needs and are heavily utilized by other public and private research organizations. They include the National Seed Storage Laboratory and other facilities for plant germplasm introduction and preservation; clonal repositories; disease-free seed stock; the ARS Culture Collection; and other taxonomic collections of plants, microbes, and insects.

Critical Mass of Scientific Talent--The diversity of its scientific work force allows ARS to assign critical masses of scientific talent to geographically broad problems not readily undertaken by State, private, or industrial institutions. Research teams can be established from ARS' own scientific resources and used in coordination with resources of the State agricultural experiment stations and other institutions. These teams can attain the critical mass that is vital to the interaction and stimulation needed for scientists to generate new ideas and resolve complex problems.

- Extensive Resources Specific to Research in Agriculture--Much of ARS resources of expertise and facilities complements and supports other parts of the full agricultural research system. Its regional research centers are invaluable national resources; they are recognized internationally as premier agricultural research establishments. ARS has specialized facilities for research on exotic diseases of animals and plants and on the insect vectors of such diseases.
It also has resources for implementing long-term, high-cost, high-risk research in facilities that other research organizations cannot establish or maintain. The reservoir of information and experience at ARS research centers is highly important to the continuity and progress of the full U.S. agricultural research and development system. In addition, ARS has the capability to develop scientists through its Office of Higher Education.

ORGANIZATION AND OPERATION OF THE AGRICULTURAL RESEARCH SERVICE

ARS is centrally managed by the Administrator, who is located at the USDA Headquarters in Washington, D.C. He is assisted in planning, budgeting, and managing the overall ARS program by the ARS National Program Staff (NPS), which is led by the Deputy Administrator. The Deputy Administrator is located at the Beltsville, Maryland, Agricultural Research Center. General performance of research is managed through four Regional Administrators who are responsible for activities in each of the four geographic regions shown in Appendix C. These regions roughly correspond to the four State agricultural experiment station regions. Each region operates under standard hierarchical management, and certain responsibilities are delegated to Area and Center Directors. Certain cross-cutting activities may be assigned to mid-level project managers.

Administrator

The Administrator is responsible for all ARS activities, including planning, executing and balancing programs, and deploying resources to achieve the objectives of the Agency. He formulates ARS policy and advises the Department on policy relating to national agricultural research matters. He has overall responsibility for coordinating ARS' planned activities with cooperators in the public and private sectors and with other Federal agencies served by ARS. He is responsible for assessing general program progress and evaluating broad program areas for performance in attainment of stated goals and objectives. He also represents ARS to the Assistant Secretary for Science and Education, the Secretary of Agriculture, and other such Cabinet- and sub-Cabinet-level Administrators with whom ARS interacts.

Deputy Administrator, National Program Staff

The Deputy Administrator serves as the leader of the NPS. He and his staff are the Administrator's chief technical advisers for national research programs and are responsible for the technical excellence of the national research programs. He and his staff have direct responsibility for leading budget development, coordination, review, and evaluation of ARS national programs to ensure proper interaction, balance, and distribution of research efforts focused upon national and major regional issues.

The Deputy Administrator and the NPS are responsible for--

- Providing national technical leadership of ARS programs;
- Establishing long-range goals, strategic and operational plans, and program priorities;
- Planning and conducting program reviews;

- Coordinating, monitoring, and evaluating national and regional programs;

- Maintaining coordination with scientists, administrators, and public and private cooperators on research and budget needs; and

- Providing liaison for ARS programs between ARS and the Federal, State, private, and public interactors with the ARS system.

Regional Administrators

ARS Regional Administrators are responsible for laboratory and field implementation of ARS' programs in their respective Regions in accordance with the Administrator's policies and the stated goals and objectives of the ARS Strategic Plan. They are responsible for implementing that part of the national operational plan that falls within their respective Regions and for ensuring that such implementations are in full agreement with the national plan. Regional Administrators, with the Deputy Administrator and NPS, provide counsel to the Administrator on policy issues and budget development. Regional Administrators serve as line managers for ARS program implementation through a hierarchy of Area and Center Directors and of Research Leaders at individual locations. They are responsible for program performance and resource management at the regional level.

The Regional Administrators and their Area and Center Directors--

- Direct and execute approved programs;

- Recruit, employ, evaluate, and make the best utilization of ARS scientists in keeping with national program needs and requirements;

- Participate with NPS in planning and conducting program reviews and in executing recommendations resulting from them;

- Approve annual reports and plans, as well as position resource management plans;

- Participate with NPS, through the ARS Budget Board, in developing the ARS budget; and

- Maintain coordination with State experiment station directors, regional councils, and other individuals and groups that have an interest in agriculture.

ARS FACILITIES

The ARS facilities for agricultural research are extremely diverse and unequaled throughout the world. Research is conducted at many centers, laboratories, and locations that range in size from small stations to the large 450-scientist facility at the Beltsville, Maryland, Agricultural Research Center.

Most facilities are owned and operated by ARS, but several locations are provided by the U.S. General Services Administration or are leased. Some locations are designed to address research problems that have a very specific focus. Other facilities, such as the Beltsville Agricultural Research Center, have a wide array of programs that are best addressed by a multidisciplinary approach and require equipment and facilities for many scientific disciplines and activities. ARS facilities are located throughout the United States and overseas so that problems of regional, national, and international nature can be addressed under the most favorable research environment. Many are located on university campuses and State agricultural experiment stations to assure cooperation and interaction with State scientists.

This type of arrangement encourages joint use of expensive research equipment, as well as of other essential facilities such as libraries, computers, and experimental plots. The following is a descriptive listing of ARS facilities grouped according to the following areas of agricultural research activity: Major National and Regional Centers; Human Nutrition Research Centers; Crop Sciences Facilities; Livestock and Veterinary Sciences Facilities; Post Harvest Science and Technology Facilities; and Soil, Water, and Air Sciences Facilities.

Major National and Regional Centers

Beltsville Agricultural Research Center (BARC)--With more than 450 full-time scientists, BARC is the largest center of excellence for national agricultural research in the United States and, possibly, the world. More than 7,000 acres of land are intensively utilized for plant and animal research. The hundreds of buildings meet the many specialized needs of the research program and house highly specialized equipment such as the computerized calorimeter in the Energy Metabolism Laboratory. The National Agricultural Library, located on the Center's grounds, is an important resource for all scientists. The close proximity of BARC to the Nation's Capital, headquarters for many Government agencies that include action and regulatory agencies and numerous research institutions associated with agriculture, is unique. The Center provides a panorama of agricultural research for visitors from many agencies and from many nations.

BARC has many interdisciplinary research teams of scientists with expertise in all agricultural disciplines and nearly all commodities. The Center is in a unique position to assemble scientific resources to attack specific problems of national importance. In addition, BARC houses major national taxonomic collections of insects, fungi, seeds, nematodes, animal parasites, and rhizobia. These collections and their evaluations provide essential national services for other scientists, for industry, and for regulatory agencies. The Center is located in Beltsville, Md.

Regional Research Centers and the Richard B. Russell Agricultural Research Center--The four regional research centers, together with the Richard B. Russell Agricultural Research Center, comprise a resource unmatched throughout the world. Each center represents a unique concentration of scientists with specialized scientific knowledge and of highly specialized instrumentation and equipment essential to conducting the basic and applied research needed to solve complex agricultural problems. Nearly 600 scientists are located at these five centers.

Each center has the scientific and engineering expertise necessary to respond to emergency needs of national or regional importance and to provide the continuity of effort required to conduct long-term basic research. The centers are especially capable of dealing with problems associated with postharvest technologies critical to the delivery of high-quality, nutritious, and safe food and fiber to consumers. Thus, the centers bridge the gaps among the interests of agriculture, industry, and consumers. The facilities are the Eastern Regional Research Center, Wyndmoor, Pa.; Northern Regional Research Center, Peoria, Ill.; Southern Regional Research Center, New Orleans, La.; Western Regional Research Center, Albany, Calif.; and Richard B. Russell Agricultural Research Center, Athens, Ga.

National Arboretum--The U.S. National Arboretum, established by an Act of Congress on May 4, 1927, comprises 444 acres in Washington, D.C. The Arboretum is a research institution for trees and other ornamental plants. Its work includes the improvement of plants through introduction, breeding, and selection. In 1973 the Arboretum was placed on the National Register of Historic Places.

The Arboretum has a major herbarium containing 500,000 botanical specimens for research and plant identification, and it publishes botanical findings and provides technical information to the public. In addition, it exchanges seed and plant material with other scientific institutions throughout the world to provide researchers with needed genetic resources and to enrich the educational collections displayed at the Arboretum.

Although not a park in the usual sense, the Arboretum provides ample opportunity for observing and enjoying plants. It has a steady flow of visitors--including scientists, landscape architects, gardeners, school children, and tourists--from around the world. As many as 20,000 people a day may visit the grounds and displays. The Arboretum is located in Washington, D.C.

Human Nutrition Research Centers

Human nutrition research is conducted at five research centers. Each has specific goals and objectives.

Beltsville Human Nutrition Research Center--The center at Beltsville, Md., plans and conducts research related to nutrient requirements for proteins, carbohydrates, lipids, vitamins, and minerals for optimal health and disease prevention. Research activities are associated with--

- Composition of foods containing the nutrients required by and biologically useful to humans; and

- Human requirements for proteins, carbohydrates, energy intake, lipids, minerals, and vitamins; and with the identification of the forms of these nutrients in various foods.

Grand Forks Human Nutrition Research Center--The center at Grand Forks, N. Dak., plans and conducts research related to human nutrient requirements, with emphasis on trace minerals. Research activities are associated with--

- Nutritional requirements for zinc, nickel, copper, and other minor elements and their relationships to optimal health, function, and performance;

- Physiological and biochemical factors that influence requirements for minor elements in all age groups; and

- Biological availability of minerals and the effects of nonnutritive factors in foods on availability of minerals.

Children's Nutrition Research Center at Baylor College of Medicine--The center, at Houston, Tex., plans and conducts research to develop a scientific basis for standards of nutrient intake and assessments of nutritional status. Research activities are associated with--

- Nutrient requirements in infants, children, and pregnant and lactating women;

- Relationships between nutrition and physical and mental development; and

- Role of diet in optimum growth and development.

Human Nutrition Research Center on Aging at Tufts University--The center at Boston, Mass., plans and conducts research on

nutrient needs of the elderly and the relation of dietary factors to the aging process. Research activities are associated with--

- Nutritional needs for optimal health, function, and performance throughout life; and

- Nutritional requirements in the aging population.

Western Human Nutrition Research Center--The center at San Francisco, Calif., plans and conducts research related to intervention programs and nutritional requirements. Research activities are associated with--

- Factors resulting in suboptimal nutritional status;

- Reliable, efficient, and inexpensive methods for defining nutritional status;

- Human nutritional requirements; and

- Nutritional criteria for designing and evaluating intervention programs.

Crop Sciences Facilities

Aquatic Weed Research Laboratories--Multidisciplinary teams that include weed scientists, plant physiologists, biochemists, chemists, soil scientists, entomologists, plant pathologists, ecologists, marine biologists, and others cooperate to develop ecological, mechanical, biological, chemical, and integrated management systems for the control of aquatic weeds in irrigation systems, drainage canals, water reservoirs, farm ponds, and other aquatic sites. Greenhouses, controlled-growth phytotrons, experimental ponds, model irrigation systems, and quarantine and other unique facilities are available for evaluating fish, insects, plant pathogens, snails, mammals, other biological organisms, selective chemicals, and water management as means of controlling aquatic weeds. Cooperating with ARS in these efforts are other Federal agencies, State agricultural experiment stations, and industrial organizations that generally do not maintain research staffs and facilities for research on aquatic weeds. The facilities are located at the Aquatic Weed Control Research Laboratory, Fort Lauderdale, Fla.; Southern Weed Science Laboratory, Stoneville, Miss.; Weed Control Research Laboratory, Prosser, Wash.; and Aquatic Weeds Control Research Laboratory, Davis, Calif.

Barley and Malting Quality Laboratory--This laboratory, which has unique facilities for determining malting quality, serves Federal and State research programs in the North Central, Mississippi Valley, and western barley-growing regions. Specialized facilities for studying the biochemistry of malting are provided to serve these projects, as well as to investigate basic processes involved in malting. The laboratory is located in Madison, Wis.

Bee Research Laboratories--In these ARS laboratories, a critical mass of scientists with special expertise work on pollination problems of importance to the whole country. These facilities are equipped with specialized support buildings and cages. For example, isolation is required so that large numbers of normal and specialized bee colonies can be maintained near the laboratories. Facilities are located at the Honey Bee Pesticides and Disease Research Laboratory, Laramie, Wyom.; Bee Breeding and Stock Center, Baton Rouge, La.; Carl Hayden Bee Research Center, Tucson, Ariz.; and Wild Bee Biology and Systematics Research Laboratory, Logan, Utah.

Biological Control Research and Quarantine Facilities--These laboratories house specialists experienced in foreign and domestic field or laboratory studies of exotic beneficial organisms that may be used to control pest insects, pathogens, and weeds. The concentration of expertise in a few, highly secure quarantine facilities where research can be done safely produces an excellent environment for conducting fundamental and applied research. These facilities are used by State departments of agriculture, State agricultural experiment

stations, USDA's Animal and Plant Health Inspection Service, USDA's Forest Service, and other organizations that wish to actually release organisms in the field. Facilities are located at the Plant Disease Research Laboratory, Frederick, Md.; Delta States Research Center, Stoneville, Miss.; Beneficial Insects Research Laboratory, Newark, Del.; Biological Control of Weeds Laboratory, Albany, Calif.; Biological Control of Insects Research Unit, Columbia, Mo.; Biological Control of Insects Laboratory, Tuscon, Ariz.; Biological Control of Weeds Research Laboratory, Buenos Aires, Argentina; European Parasite Laboratory, Sevres, France; Biological Control of Weeds Laboratory, Rome, Italy; and Asian Parasite Laboratory, Seoul, Korea.

Cereal Disease Laboratories--These two laboratories have specialized facilities for investigating the behavior of major cereal diseases of national scope. The laboratories maintain national oversight of the epidemiology of major cereal diseases, conduct and maintain national surveys of disease races, and investigate the basic genetics of disease resistance. The facilities are located at the Cereal Rust Laboratory, St. Paul, Minn., and the Corn Virus Research Laboratory, Mississippi State, Miss.

Cotton Research Laboratories--These four laboratories are located in production regions that differ in soil type, climate, water management, and pests. At each location, teams of 9 to 16 geneticists, agronomists, physiologists, and plant-protection scientists work together to develop improved cotton production systems. Facilities are located at the ARS Western Cotton Research Laboratory, Phoenix, Ariz.; U.S. Cotton Research Station, Shafter, Calif.; Cotton Insects Research Laboratory, Brownsville, Tex.; and Cotton Research Laboratories, College Station, Tex.

Crop Commodity Insect Control Research Facilities--These facilities provide locations where a critical mass of scientists--entomologists, plant breeders, geneticists, plant physiologists, chemists, engineers, and others--can cooperate in efforts to develop tactics, strategies, and systems that may reduce losses of major commodities to insect pests. These concentrations of personnel permit the effective use of rearing facilities, greenhouses, and specialized equipment. In addition, they facilitate the interdisciplinary research required to solve complex pest-management problems of national importance. Facilities are located at the Cotton Insects Physiology Research Unit, Baton Rouge, La.; Cotton Insects Research Laboratory, Brownsville, Tex.; Southern Grain Insects Research Laboratory, Tifton, Ga.; Northern Grain Insects Research Laboratory, Brookings, S. Dak.; Citrus Insects Research Laboratory, Weslaco, Tex.; Fruit and Vegetable Insects Research Laboratory, Vincennes, Ind.; Yakima Agricultural

Research Laboratory, Yakima, Wash.; Subtropical Horticultural Research Station, Miami, Fla.; Boll Weevil Research Laboratory, Mississippi State, Miss.; Boll Weevil Eradication Research Laboratory, Raleigh, N.C.; and Boyden Entomology Laboratory, Riverside, Calif.

Crops Research Laboratories--These two laboratories are located in productic, regions that differ in soil type, climate, water management, and pests. The research is conducted on sugarbeets, forage, and range and is aimed at breeding and production practices and pest control. Multidisciplinary teams of 10 to 12 scientists include plant breeders, geneticists, agronomists, plant pathologists, physiologists, and nematologists. In addition to office-laboratory space, the facilities include greenhouses with growth chambers, temperature- and humidity-controlled chambers for sugarbeet storage, and special isolation chambers for pollination. Facilities are located in Ft. Collins, Colo., and Logan, Utah.

Forage-Range-Livestock Research Stations--These five ARS stations are located in different production regions. Soil type, plant and animal species, climate, and other environmental factors interact to create unique agricultural production situations of national importance. At each location, teams of 4 to 10 scientists of many disciplines--breeders, geneticists, physiologists, agronomists, range and animal scientists, pathologists, and entomologists-- interact to solve problems and to increase production of forage and livestock from grasslands. These teams also work closely with scientists of other research agencies. Facilities are located at the U.S. Regional Pasture Research Laboratory, University Park, Pa.; North Central Dairy Forage Research Center, Madison, Wis.; U.S. Southern Great Plains Field Station, Woodward, Okla.; Squaw Butte Research Station, Burns, Oreg.; and Jornada Experimental Range Management Station, Las Cruces, N. Mex.

Fruit and Nut Crop Repositories--These repositories have been specifically located and maintained to provide vegetatively produced plant germplasm for U.S. scientists and are the first two of several planned. The Oregon repository maintains pome fruits, small fruits, filberts, hops, and mint. The California repository maintains stone fruits, grapes, walnuts, almonds, and certain minor crops. Involved are the collection, propagation, maintenance, and preliminary evaluation of such crops. These repositories are managed by curators and provide public, industry, and private breeders and other plant scientists with germplasm needed for crop improvement programs. They are distinct and separate from breeders' working collections. Facilities include office-laboratory space, screenhouses, greenhouses, isolation field plots, and temperature- and humidity-controlled storage chambers. The repositories are located in Corvallis, Oreg. and Davis, Calif.

Insect Attractants, Behavior, and Basic Biology Research Laboratory--The research at this laboratory is basic to management of insect pests of crops, stored products, and humans. The facility is unique because it is suitable for basic research on most processes of insect growth and development and of insect reception and response that are now believed to be the key to ecologically sound, selective, and safe methods of insect pest management. Unique instrumentation and skills have enabled the laboratory to solve problems for which solutions previously appeared to be difficult; for example, identifying and synthesizing attractants of serious insect pests. As a result, attractant pheromones for the Japanese beetle and for peach tree borers are now in commercial use. Behavioral and bioengineering research have yielded concepts and techniques that have been adopted to assure the quality of mass-reared sterile screwworms, Mediterranean fruit flies, and other insects. The use of pheromones and insect growth regulators to protect stored peanuts and other agricultural commodities has been developed to the pilot stage. The laboratory is located in Gainesville, Fla.

Mayaguez Institute of Tropical Agriculture--The mission of this institute is to aid continental U.S. agriculture by providing winter nurseries that permit year-round outdoor experimentation and development; to introduce, evaluate, select, multiply, preserve, and develop tropical crop germplasm of interest to U.S. agriculture; to aid the agriculture of Puerto Rico by conducting carefully selected cooperative studies; and to contribute to the development of agriculture in the tropics. The institute consists of one major building and 34 smaller support buildings on 207 acres of land adjacent to the University of Puerto Rico. In addition, a 125-acre farm, located about 25 miles north of Mayaguez at Isabela, consists mainly of experimental plots that include winter nursery operations. The institute provides an ideal location for a unique collection of subtropical and tropical plant germplasm. The institute is located in Mayaguez, P.R.

Metabolism and Radiation Research Laboratory--This national laboratory was established in 1964 to investigate the fate of pesticides, drugs, and other agricultural chemicals applied to crops, feeds, and livestock and to identify and explore insect vulnerabilities that can be exploited in managing insect pests. The laboratory has a highly trained interdisciplinary staff, unique equipment for irradiating insects, and an excellent collection of high-precision instruments for chemical analyses. The laboratory established, between wheat and wild oats, enzymatic differences that have been exploited by industry; established that diethylstilbestrol is stored in the livers of livestock; and discovered the first practical method of

11-864 O - 83 - 9

sexually sterilizing boll weevils. The laboratory is located in Fargo, N. Dak.

National Seed Storage Laboratory--The National Seed Storage Laboratory, on the campus of Colorado State University, has been in operation since 1958. The mission of the laboratory is long-term preservation of valuable plant germplasm as viable seeds and research related thereto. Long-range studies focus on biochemical, physiological, and genetic changes in seeds during storage and the effects of seed moisture content, storage environment, and storage containers on seed longevity. Laboratory procedures for accurate monitoring of seed viability during storage are established on a crop-by-crop basis. Several million seeds, representing nearly 100,000 varieties, are stored in 11 cold-storage rooms. The laboratory is located in Ft. Collins, Colo.

Offshore Insect Control Research Facilities--ARS facilities in Hawaii and the Virgin Islands allow entomologists to conduct research and to produce experimental materials, such as sterile fruit flies, in isolated microcosms of mainland agricultural conditions. At the same time, the scientists can conduct research of direct benefit to these tropical and subtropical areas. These isolated locations form a unique national resource because they allow evaluation of procedures for managing pests that cause widespread damage to mainland crops and livestock. Facilities are located at the ARS Fruit Fly Laboratory, Honolulu, Hawaii; Hawaiian Agricultural Experiment Station, Hilo, Hawaii; and Federal Experiment Station, Kingshill, St. Croix, V.I.

Ornamental Plant Research Laboratory--This central laboratory was established to serve the needs of florists and nursery crop producers in the Pacific Northwest. The office-laboratory building is occupied by a multidisciplinary team of scientists consisting of plant pathologists, physiologists, an entomologist, an agronomist, and a soil scientist. The facility includes greenhouses, special isolation houses for pesticide research, and shade houses. Field work is conducted on nearby land leased from the State. The laboratory is located in Corvallis, Oreg.

Peanut Production, Disease, and Harvest Research Laboratory--This laboratory is located in the center of the Mid-Atlantic peanut production area. An interdisciplinary team of breeders, plant physiologists, and engineers work together to develop peanut production systems, applicable to the entire peanut production area, that will increase yield and improve product quality. The drying laboratory provides unique facilities for controlled studies of peanut drying. Work at this

facility is coordinated with work at other research institutions. The laboratory is located in Suffolk, Va.

U.S. Plant Introduction Station--This facility is the only USDA location for processing foreign plant germplasm that must be quarantined upon arrival in the United States. It is located in a nonagricultural area to ensure isolation of imported material, yet it is within a few miles of the Beltsville Agricultural Research Center and its available expertise.

Facilities include specially designed greenhouses and screenhouses for the maintenance of prohibited crop categories and foreign germplasm. Onsite expertise is available for performing indexing tests to detect a wide array of viruses, mycoplasmas, protozoa, spiroplasmas, and viroids. At the facilities are office-laboratory buildings that include 13 glasshouses, as well as cold rooms and specialized equipment. Plant varieties assembled on the grounds include 800 apple, 600 pear, 250 stone fruit, and 700 woody ornamental varieties. The station is located in Glenn Dale, Md.

Regional Plant Introduction Stations--These stations are located in the four geographic regions of the country for close cooperation with the State agricultural experiment stations. Each station is responsible for receiving, maintaining, increasing, distributing, and evaluating seeds of a specific array of crops and of potentially new crop species. These facilities are a key part of the national plant germplasm system, and they provide valuable national and international services to plant breeders, geneticists, and other scientists in the public and private sectors. Facilities are located in Experiment, Ga.; Ames, Iowa; Geneva, N.Y.; and Pullman, Wash.

Rice Research Laboratory--This laboratory is located on a State agricultural experiment station comprising nearly 1,000 acres. ARS scientists here study rice breeding, quality, diseases, drying after harvest, and storage insects. Onsite solar collectors and heat-storage units enable engineers to conduct pilot tests to improve rice drying with minimum energy inputs. The availability of more than 25 storage bins permits the study of rice-quality preservation over a period of several years. The ARS team effort encourages development of a quality-rice variety that will be resistant to plant diseases and postharvest insect attack. Because numerous commercial rice mills are located nearby, insect contamination of processed rice can be studied. The laboratory is located in Beaumont, Tex.

Subtropical Horticultural Research Station--This station is situated on 200 acres south of Miami. The staff consists of entomologists, plant pathologists, horticulturists, and an organic chemist. Research at the facility involves pest

control, reduction of marketing losses, and varietal and cultural improvement of subtropical plants. The station maintains unique germplasm collections of coffee, cacao, sugarcane, and other tropical and subtropical plants. The facility also provides for Federal and State cooperative programs on survey and detection of pests and on nursery inspection, postentry quarantine inspection, and development of coconut palms resistant to lethal yellowing disease. The station is located in Miami, Fla.

Sugarbeet and Vegetable Research Station--This facility serves the unique vegetable and sugarbeet production area of California's Salinas Valley and other production areas in the Western States. The valley opens to the ocean, making the location ideal for cool-season vegetables and sugarbeets. The facility includes an office-laboratory building, special greenhouses for isolation breeding, an electron microscope, a fully equipped agricultural engineering shop, and 100 acres of field plots. The station is located in Salinas, Calif.

Sugarcane Mechanization Laboratory--This facility provides shops and engineering laboratories that meet the space requirements for construction and testing of large field machines being developed for use in sugarcane production. The equipment developed at this facility is intended for use in both the Florida and Louisiana cane-production areas. Preliminary testing of new research concepts is conducted in ARS facilities, and field tests are conducted in State and privately owned fields. The laboratory is located in Belle Glade, Fla.

Sugarcane Research Laboratories--These two laboratories are located in sugar-production regions with different ecologies, soil types, water-management systems, diseases, insects, and cultural practices. Multidisciplinary teams include plant breeders, geneticists, agronomists, plant pathologists, plant physiologists, weed-control specialists, and entomologists. These locations have unique facilities, including large, tall, isolation-crossing houses with rail carts that move plants indoors at night, air-conditioned photoperiod houses, growth chambers, temperature- and humidity-controlled storage rooms, and sugarcane milling and harvesting equipment. Office-laboratory space is provided for 10 to 14 scientists. The facilities are located in Canal Point, Fla., and Houma, La.

Tree Fruit and Tree Nut Research Stations--Five regional research stations are located in production areas that differ in fruit-crop adaptation, soil type, climate, water management, and pests. Studies of tree fruit and tree nut crops differ by region and are conducted on citrus, apples, pears, peaches and other stone fruits, pecans, blueberries, and strawberries.

Teams of horticulturists, geneticists, pathologists, physiologists, entomologists, soil scientists, and agricultural engineers cooperate to develop new fruit and nut varieties and improved cultural systems. Scientific teams range from 4 to 18 scientists at the various locations. The research on perennial fruit crops is dedicated to long-range problems--research that is not easily initiated or justified by individual State agricultural experiment stations. The facilities are located at the Appalachian Fruit Research Station, Kearneysville, W. Va.; Production, Harvesting, and Handling of Tree Fruits, Wenatchee, Wash.; W. R. Poage Pecan Field Station, Brownwood, Tex.; Small Fruits Research Station, Poplarville, Miss.; Southeastern Fruit and Tree Nut Research Laboratory, Byron, Ga.; and U.S. Horticultural Research Laboratory, Orlando, Fla.

U.S. Delta States Agricultural Research Center--This research center emphasizes multidisciplinary, mission-oriented research in the basic and applied sciences, with the following objectives: Developing technology for improving crop production, harvesting, and processing efficiency; developing cost-effective technology for reducing crop losses caused by weeds, diseases, insects, and nematodes; improving environmental quality; and improving yields and quality of crops. Plant scientists, engineers, weed scientists, entomologists, plant pathologists, plant physiologists, chemists, nematologists, and soil scientists cooperate in contributing to these objectives.

Resources include controlled-growth phytotrons; greenhouses; research quarantine facilities for insects, plant pathogens, nematodes, and weeds; and large areas of land for field experiments. Research at the center is planned in cooperation with the States and industry to ensure emphasis on regional and national problems. The facility is located in Stoneville, Miss.

U.S. Vegetable Laboratory--This central facility was established as a regional laboratory to serve all of the Southeastern States for breeding, production, and protection of vegetable crops. It is located on 350 acres of prime vegetable cropland. It includes a large office and laboratory, a seed-storage building, special insect-rearing rooms, laboratories, vegetable-storage facilities, and several greenhouses. Scientists include geneticists, horticulturists, pathologists, agronomists, entomologists, nematologists, and a chemist. The Southeastern Forestry Research Laboratory is also located on the property, and a State substation occupies adjacent land. The facility is located in Charleston, S.C.

Livestock and Veterinary Sciences Facilities

Animal Disease Research Laboratories--The animal disease research efforts in ARS are concentrated at seven locations. One of these, the National Animal Disease Center in Ames, Iowa, is the largest such unit in the world and has a mission to conduct basic and applied research on diseases of national importance in cattle, sheep, swine, horses, and poultry. The staff uses multidisciplinary approaches to solve animal health problems. The other animal disease laboratories are unique in that each specializes either in a single disease area or in specific diseases of a single animal species. The laboratories are located where a disease exists and where their scientists can readily collaborate with research scientists of other institutions. Chemists, virologists, bacteriologists, veterinarians, physiologists, entomologists, and pathologists work together on interdisciplinary approaches to disease control.

These ARS laboratories can conduct in-depth studies on economically important diseases that do not cause catastrophic losses and, therefore, often do not command continued support from State agencies or other Federal agencies. Because of their highly skilled staffs, the laboratories are excellent training locations for U.S. and foreign scientists who need specialized training. The large, interdisciplinary staffs also provide the United States with a highly trained research and diagnostic staff that can be mobilized rapidly to meet any animal disease emergency. Facilities are located at the National Animal Disease Center, Ames, Iowa; Arthropod-Borne Animal Disease Research Laboratory, Denver, Colo.; Animal Disease Research Unit, Pullman, Wash.; Southwestern Livestock and Forage Research Station, El Reno, Okla.; Regional Poultry Research Laboratory, East Lansing, Mich.; Southeast Poultry Research Laboratory, Athens, Ga.; and South Central Poultry Research Laboratory, Mississippi State, Miss.

Foreign Animal Disease Research Centers--ARS has unique responsibilities for research on animal diseases that do not exist in the United States but pose a continuous threat to U.S. livestock and poultry industries. The major portion of this research is conducted at the ARS laboratory on Plum Island, 1.5 miles off Long Island. One serious foreign disease being studied is foot-and-mouth disease which affects all farm animals except horses and poultry. By law the Plum Island laboratory is the only U.S. facility where this disease can be studied.

Another disease being studied extensively at the laboratory on Plum Island is African Swine Fever. No vaccine is available for this disease, which poses a serious threat to swine. Other foreign animal diseases that have been or are now being studied are rinderpest; contagious bovine pleuropneumonia; African

horsesickness; exotic strains of bluetongue; sheep pox; duck virus enteritis; Teschen disease of pigs; swine vesicular disease; and a serious blood-parasite disease called East Coast fever.

Under strict security regulations imposed by ARS and the Animal and Plant Health Inspection Service (APHIS), studies of fowl plague and exotic Newcastle disease are conducted by ARS at a laboratory in Athens, Ga. Another high-security facility for the study of insect-borne foreign diseases is located in Denver, Colo. A multidisciplinary team of veterinarians, microbiologists, immunologists, biochemists, electron microscopists, and pathologists develops research information that is essential in the diagnosis, prevention, control, and eradication of serious exotic diseases of animals that might gain entry into the United States. Facilities are located at the Plum Island Animal Disease Center, Greenport, N.Y.; Southeast Poultry Research Laboratory, Athens, Ga.; Arthropod-Borne Animal Disease Research Laboratory, Denver, Colo.; and Animal Disease Laboratory, Nairobi, Kenya.

Insects Affecting Livestock Laboratories--ARS research on insects affecting livestock is the largest single component of the U.S. effort to control insect pests. The work serves the livestock industry, which accounts for about half the cash income of American farmers. It also supports action programs of other agencies. For example, personnel are assisting in the screwworm eradication program being conducted by APHIS, in cooperation with Mexico, and plans have been made for future cooperative research with Canada's Agriculture Ministry to control the cattle grub. Other research is underway to support APHIS in efforts to control Texas cattle fever and cattle scabies.

The multidisciplinary teams of entomologists, chemists, immunologists, virologists, physiologists, and engineers at the several laboratories can be assembled and mobilized on short notice. They have the flexibility to conduct cooperative programs with APHIS, State agricultural experiment stations, and other governmental organizations on a regional, interregional, national, or international basis. Facilities are located at the Screwworm Research Laboratory, Mission, Tex.; Hemoparasite Disease Research Laboratory, Pullman Wash; Arthropod-Borne Animal Disease Research Laboratory, Denver, Colo.; Midwest Livestock Insects Research Laboratory, Lincoln, Nebr.; Livestock Insects Laboratory, Beltsville, Md.; Veterinary Toxicology and Entomology Research Laboratory, College Station, Tex.; Metabolism and Radiation Research Laboratory, Fargo, N. Dak.; Gulf Coast Mosquito Research Laboratory, Lake Charles, La.; U.S. Livestock Insects Laboratory, Kerrville, Tex.; Lone Star Tick Laboratory, Poteau, Okla.; Cattle Fever Tick Research Laboratory, Falcon Heights, Tex.; and Mayaguez Institute of Tropical Agriculture, Mayaguez, P.R.

Insects Affecting Man Laboratories--ARS research on insect pests of humans is the major such effort in the world. Most of the work is conducted in Gainesville, Fla., one of the largest and most specialized research facilities of its kind. Much of this work is conducted in support of the U.S. Department of Defense, which is concerned with preventing insect-borne diseases such as malaria, dengue, and encephalitis from reducing the efficiency of U.S. military personnel at home and abroad. In addition, personnel from the Gainesville laboratory serve as the technical nucleus for cooperative research with international organizations such as the United Nations and the U.S. Agency for International Development. A recent example of this type of cooperation was a project on the control of malaria-infectious mosquitoes in Central America.

The laboratory at Lake Charles, La., is strategically located for research on regional problems in support of APHIS programs. At both locations, the multidisciplinary teams of entomologists, epidemiologists, geneticists, and engineers can assist in instances in which State or local organizations may not have the desired expertise. Personnel serve as technical advisers to action agencies, such as APHIS, in times of disease outbreaks or vector-population explosions. Facilities are located at the Insects Affecting Man and Animals Research Laboratory, Gainesville, Fla.; Gulf Coast Mosquito Research Laboratory, Lake Charles, La., and Imported Fire Ant Research Laboratory, Gulfport, Miss.

Facilities for Research on Internal Parasites of Animals--The primary objective of the national parasite research program is to develop ways to prevent, control, or eradicate parasite infestations in livestock and poultry. The major unit in the program, the Animal Parasitology Institute, is the largest in the world devoted exclusively to research on parasites of food-producing animals. Parasitologists, veterinarians, chemists, entomologists, and immunologists cooperate in interdisciplinary approaches to achieve stated goals.

The ARS parasite research program provides for unbiased testing and evaluation of new antihelminthic drugs and proposed biological parasite control programs. The scientists also prepare and maintain two internationally known tools used by parasitologists worldwide: the Index Catalogue of Medical and Veterinary Zoology and the National Parasite Collection. Both are used nationally in studies of parasitism in livestock and poultry and are indispensable in efforts to develop parasite-control programs. Facilities are located at the Animal Parasitology Institute, Beltsville, Md., and the Regional Parasite Research Laboratory, Auburn, Ala.

Multidisciplinary Animal Production Research Centers--In addition to the major research effort at the Beltsville Agricultural

Research Center, ARS has several major research locations where large-scale research with dairy and meat-producing animals is conducted by multidisciplinary teams. Several of the research stations are the largest in the country, up to 56,000 acres in area, and their size enhances their ability to attract and retain high-quality scientists from many disciplines. The unique facilities and equipment range from sophisticated chambers for energy metabolism studies on individual animals to commercial-size production units for all classes of animals. The integrated programs conducted range from very basic research to studies in which large populations of animals are used in developing systems approaches to solve broad industry problems. Stations are strategically located to permit replicated studies in different physiographic situations to quantify interactions among genetic, nutritional, and management variables. Thus, programs of small stations become integrated parts of total programs and uniquely complement the programs of large stations.

Many of the large units are operated cooperatively with State agricultural experiment stations and serve as focal points for integrated research efforts, thereby enhancing the effectiveness of total research programs. In addition to the Beltsville Agricultural Research Center, Beltsville, Md., facilities are located at the U.S. Livestock Experiment Station, Miles City, Mont.; U.S. Sheep Experiment Station, Dubois, Idaho; Roman L. Hruska U.S. Meat Animal Research Center, Clay Center, Nebr.; Southwestern Livestock and Forage Research Station, El Reno, Okla.; North Central Dairy-Forage Research Center, Madison, Wis.; and Brooksville Beef Cattle Research Station, Brooksville, Fla.

Poultry Production and Product Quality Laboratories--In addition to the poultry research programs at the Beltsville Agricultural Research Center, three major poultry-production and product-quality laboratories uniquely blend basic and applied studies using multidisciplinary team approaches. Interrelationships of the neuro-nutritional-endocrine systems are being investigated to improve turkey egg production. Unique cellular approaches are being used to study growth and the effect of stress on broilers. Agricultural engineers and poultry scientists are working on the effects of environment and management factors such as utilization of heat energy, limited area brooding, and control of environmental temperatures on the meat and egg production of chickens. Approaches being used to improve broiler product quality include investigating cage-rearing systems as a model for studying breast blisters and bone fragility; and studying ways to reduce the synergistic effects of several mycotoxins found in some feeds. Facilities are located at the Poultry Research Laboratory, Georgetown, Del.; Southeast Poultry Research Laboratory, Athens, Ga.; and South Central Poultry Research Laboratory, Mississippi State, Miss.

Post Harvest Science and Technology Facilities

Animal Products Research Laboratories--Fundamental and applied research is conducted at nine laboratories across the Nation to evaluate and improve the quality and processing of animal products. Research conducted at one or more laboratories addresses processing, marketing, transportation, and distribution problems of meat, poultry, dairy products, freshwater fish, and eggs. Scientists study the biochemical, physiological, microbial, chemical, and physical changes in animals or their products during milking, egg collection, or transit, or after slaughter, and how these changes relate to genetic, production, or management practices or can be altered to protect or improve the quality and nutritional value of food produced from animals.

Techniques are developed for evaluating properties of tissues or products. Information is developed on biochemical/biophysical changes in animal tissues or products, and the mechanisms by which these are controlled or can be influenced become the basis for recommendations for maintaining and improving the quality of animal products. Knowledge of the effects of sodium on muscle protein solubility, meat emulsion stability, and the properties of muscle and milk protein could, for example, enable reduction in the amount of sodium added during processing. Research on animal products often requires an interdisciplinary approach to problems at a cellular and subcellular level. Such an approach involves food scientists, microbiologists, biochemists, physical chemists, and engineers. Often research supports Federal action agencies in their missions. Facilities are located at the Eastern Regional Research Center, Philadelphia, Pa.; Beltsville Agricultural Research Center, Beltsville, Md.; Richard B. Russell Agricultural Research Center, Athens, Ga.; Southern Regional Research Center, New Orleans, La.; ARS Bioengineering Research Laboratory, Columbia, Mo.; Northern Regional Research Center, Peoria, Ill.; ARS Transportation and Marketing Laboratory, College Station, Tex.; Roman L. Hruska U.S. Meat Animal Research Center, Clay Center, Nebr.; and Western Regional Research Center, Albany, Calif.

Cotton Quality and Ginning Laboratories--These laboratories represent a research resource found nowhere else in the world. The specialized facilities and scientific staffs of the laboratories not only provide a valuable national resource for agriculture, but also support a major segment of the domestic textile industry and a sizable export market.

The Cotton Quality Research Station at Clemson evaluates the effects of proposed changes in the production/ginning sequence on the processing quality of cotton. The Southern Regional

Research Center is a central laboratory with instrumentation for evaluating small research samples of fiber and seed for cooperating ARS scientists at approximately 10 locations across the Cotton Belt. In addition, the laboratory provides analyses for the National Cotton Variety Testing Program conducted by ARS in cooperation with various State agricultural experiment stations. Together with the ginning laboratories, the two quality laboratories provide an essential research support service to the Cotton Division of USDA's Agricultural Marketing Service, which by law is responsible for grading and classifying the American cotton crop each year. The cotton quality facilities are located at the Cotton Quality Research Station, Clemson, S.C. and the Southern Regional Research Center, New Orleans, La.

Although all three ginning laboratories perform similar functions, each is essential to addressing the special genetic and harvesting problems pertaining to the three distinct cotton-growing regions of the United States: the humid, rainy areas of the Southeast and Mississippi Delta; the arid, High Plains of Texas; and the hot, dry, irrigated areas of the Southwest and West. Buildings and facilities are specially designed to handle, dry, and gin the seed cottons produced in these three separate regions of the Cotton Belt. The ginning facilities are located at the Southern Plains Cotton Research Laboratory, Lubbock, Tex.; Southwestern Cotton Ginning Research Laboratory, Mesilla Park, N. Mex.; and U.S. Cotton Ginning Laboratory, Stoneville, Miss.

European Marketing Research Center--The mission at this location is to conduct a research program that will contribute to increased efficiency in the marketing of U.S. agricultural products in Europe. Research is concerned with the identification and resolution of commodity quality problems, mainly in horticultural crops, that will reduce handling costs cf and market losses in U.S. farm products. Facilities are located in Rotterdam, The Netherlands.

Family Resource Development Facilities--The Family Economics Research Group conducts research on the economic problems of families and the improved use of time, money, energy, and other resources by families. This group is located in Hyattsville, Md.

Scientists at the ARS Textiles and Clothing Laboratory conduct basic and applied research on the most effective use and care of textiles, clothing, and home furnishings available to consumers. The scientists disseminate research results in technical and popular publications. The laboratory shares a conditioning room with the Department of Textiles and Clothing at the University of Tennessee and, in addition to its own highly specialized textile-testing equipment, has access to

sophisticated equipment and instrumentation on the university campus. Facilities are located at the Textiles and Clothing Laboratory, Knoxville, Tenn.

Fruit and Vegetable Quality Research--Postharvest research is conducted at 12 locations throughout the United States where horticultural crops are produced, processed, and marketed. The laboratories conduct research on quality maintenance and loss reduction of horticultural crops and are located to provide direct access to growers, shippers, and receivers. To accomplish their mission, the laboratories study the effects of the preharvest environment unique to the growing area; effects of postharvest treatments for controlling pathological and physiological diseases; storage design, specifications, and environments; improved handling, packaging, and transporting methods; and chemistry and biochemistry of horticultural crops.

Research thrusts of some laboratories include energy conservation, waste reduction, and processing efficiency. Information is also developed for specifications and standards for raw and finished products. Facilities are located at the Agricultural Product Technology Research, Weslaco, Tex.; Fruit and Vegetable Chemistry Laboratory, Pasadena, Calif.; Citrus and Subtropical Products Laboratory, Winter Haven, Fla.; Food Sciences Laboratory, Raleigh, N.C.; Fruit and Vegetable Harvesting Research, East Lansing, Mich.; Red River Valley Potato Research Laboratory, East Grand Forks, Minn.; Market Quality and Handling Research Station, Miami, Fla.; Crop Protection and Production Research, Weslaco, Tex.; Market Quality and Transportation Research Laboratory, Fresno, Calif.; Production, Harvesting, and Handling of Tree Fruits Research, Wenatchee, Wash.; Commodity Treatment, Handling, and Distribution Research, Hilo, Hawaii; Horticultural Crops Quality Research, New Brunswick, N.J.; and Market Pathology Laboratory, Chicago, Ill.

Insect Control Laboratories--Ten insect control laboratories are distributed throughout the United States, so Federal scientists concerned with insect pests in stored commodities have access to the entire marketing system--from farm production to commercial storage, terminal export elevators, shipment and transportation, storage, milling, packaging, and overseas sales. These laboratories are equipped with chambers that can be used in commodity-treatment studies involving both vacuum and atmospheric test conditions. This equipment is generally not available anywhere else in the world.

Because of available laboratory facilities, investigations can proceed from studies at the basic level to studies on a scale large enough that practical problems can be identified and new

control techniques developed. Laboratory personnel include scientists, in various disciplines, in sufficient critical mass to facilitate interdisciplinary research. Facilities are located at the U.S. Grain Marketing Research Laboratory, Manhattan, Kans.; Stored Product Insects Research Laboratory, Fresno, Calif.; Hawaiian Agricultural Experiment Station, Hilo, Hawaii; ARS Fruit Fly Laboratory, Honolulu, Hawaii; Stored Product Insects Research and Development Laboratory, Savannah, Ga.; Tobacco Storage Insects Research Unit, Richmond, Va.; Insect Attractants, Behavior, and Basic Biology Research Laboratory, Gainesville, Fla.; Stored Product and Household Insects Laboratory, Madison, Wis.; Rice Experiment Station, Beaumont, Tex.; and Subtropical Horticulture Research Station, Miami, Fla.

Facilities for Research on Metabolic Safety of Agricultural Products--ARS programs constitute most of the Nation's research effort in the highly visible and increasingly important area of the metabolic safety of agricultural products. The required sophisticated equipment and facilities that could not be justified by smaller and less comprehensive units are concentrated in these facilities.

Specific objectives of the research are to (1) determine the metabolic fate of pesticides, agricultural chemicals, and drugs used to prevent and control diseases or to improve efficiency of animal production; (2) define chemical characteristics of and modes of action for and develop measures to prevent losses from poisonous plants and other naturally occurring toxicants; and (3) conduct toxicological and nutritional studies related to food and feed safety in production, processing, and distribution. Results are used by action agencies in programs to ensure the safety of animal products for consumers and to reduce the cost of production for producers. Facilities are located at the Beltsville Agricultural Research Center, Beltsville, Md.; Western Regional Research Center, Albany, Calif.; Richard B. Russell Agricultural Research Center, Athens, Ga.; Metabolism and Radiation Research Laboratory, Fargo, N. Dak.; Veterinary Toxicology and Entomology Laboratory, College Station, Tex.; and Poisonous Plant Research Laboratory, Logan, Utah.

National Peanut Research Laboratory--This laboratory, located in the heart of the Southeastern peanut production area, deals with problems associated with the quality and safety of peanuts. A multidisciplinary team, consisting of the essential scientific and engineering expertise needed to address problems in shelling, handling, grading, and storing of peanuts, provides a unique link among the farmer, small processer, and the food industry within the United States and abroad. The laboratory is located at Dawson, Ga.

U.S. Grain Marketing Research Laboratory—This laboratory provides the facilities, equipment, and critical mass of scientific and engineering expertise needed to address the full range of basic and applied research problems associated with maintenance of quality, reduction of losses, and safety in the handling and storage of grain. These capabilities are also used to resolve problems of the action agencies, particularly USDA's Federal Grain Inspection Service. This national facility complements the research capability of the milling school at Kansas State University and of the American Institute of Baking; together, they provide an unparalleled capability for resolving problems associated with our major agricultural commodities. The laboratory is located in Manhattan, Kans.

Soil, Water, and Air Sciences Facilities

Laboratories for Erosion and Sedimentation Studies--These laboratories have physical facilities--flumes, wind tunnels, raindrop towers, rain simulators, and field plots--that are unique for studying the physical processes involved in erosion, sediment transport, and sediment deposition. Multidisciplinary groups of scientists--engineers, soil scientists, chemists, agronomists, and biologists--work together to understand the processes involved in water and wind erosion, sediment transport, and sediment deposition and to develop methods for controlling erosion and sedimentation. Facilities are located at the National Erosion Research Laboratory, West Lafayette, Ind.; U.S. Big Spring Field Station, Big Spring, Tex.; and USDA Sedimentation Laboratory, Oxford, Miss.

National Tillage Machinery Laboratory--This laboratory is the only one in the United States in which soil bins and highly sophisticated instrumentation can be used to study the relationships among soil physical properties, tillage and traction devices, and machine performance. Studies are conducted on machine-mobility problems and on the effects of machine weights, traction, and flotation. The laboratory is located in Auburn, Ala.

Soil and Water Conservation Research Centers--These facilities are regional research centers that conduct soil and water conservation research applicable to the major land-use resource areas in which they are located. The facilities are federally owned and are located, in many instances, in areas where there are no universities. In some instances, cooperative efforts with State agricultural experiment stations are maintained. The centers are staffed with multidisciplinary teams, including soil scientists, agricultural engineers, plant physiologists, and agronomists, for research in broad problem areas. Some basic research is also conducted that has regional, national, and international significance. Facilities are located at the Appalachian Soil and Water Conservation Research Laboratory, Beckley, W. Va.; Plant, Soil, and Water Laboratory, Orono, Maine; North Central Soil Conservation Research Laboratory, Morris, Minn.; Northern Great Plains Research Laboratory, Mandan, N. Dak.; Central Great Plains Research Station, Akron, Colo.; Snake River Conservation Research Center, Kimberly, Idaho; Imperial Valley Conservation Research Center, Brawley, Calif.; Columbia Plateau Conservation Research Center, Pendleton, Oreg.; Soil and Water Conservation Research, Weslaco, Tex.; U.S. Southwestern Great Plains Research Center, Bushland, Tex.; Coastal Plains Soil and Water Conservation Research Center, Florence, S.C.; Southern Piedmont Conservation Research Center, Watkinsville, Ga.; Water Research Center, Sidney, Mont., and High Plains Grasslands Research Station, Cheyenne, Wyo.

U.S. Plant, Soil, and Nutrition Laboratory--This laboratory is one of the few in the world where scientists of different

disciplines are grouped together to conduct research on the geochemical and chemical processes involved in the cycling of nutritionally important substances in rocks, soils, plants, and animals. The research program includes factors controlling the distribution and availability of nutrients and the structure, synthesis, metabolism, and role of biologically important substances in the growth and development of plants, animals, and humans. The laboratory is located in Ithaca, N.Y.

Water Management Laboratories--These laboratories are located within the physiographic region where major problems of water management and associated soil problems exist. Each laboratory has a group of multidisciplinary scientists--soil scientists, plant physiologists, and engineers--who work together on basic relationships and conduct field experiments under regional climatic conditions.

Research with major crops grown in the area is conducted to develop improved water management technology for increasing water-use efficiency and minimizing soil and crop damage caused by salinity. Facilities are located at the Water Management Research Laboratory, Fresno, Calif.; U.S. Salinity Laboratory, Riverside, Calif.; U.S. Water Conservation Laboratory, Phoenix, Ariz.; Irrigation and Soil-Plant-Water Relations Unit, Fort Collins, Colo.; and Irrigation and Soil-Plant-Water Relations Unit, Grand Junction, Colo.

Watershed Research Centers--These centers, which are located in major climatological zones, consist of unique and intensively instrumented experimental facilities for evaluating the effects of crop and range activities on the environment and the effects of urbanization and mining on agriculture. Multidisciplinary teams of scientists and engineers use these research watersheds to assess the effects of land use and land treatment on water yield, flooding control, soil conservation, channel stabilization, and water quality for key physiographic regions. The research program includes fundamental studies on the movement of water, sediments, and agricultural chemicals. A major objective is the development and evaluation of improved land management and conservation technologies for use by action and regulatory agencies. Federal agencies benefitting directly from the research include the USDA Soil Conservation Service; U.S. Department of the Interior, Bureau of Mines and Bureau of Land Management; U.S. Army Corps of Engineers; and U.S. Environmental Protection Agency. Facilities are located at Southern Plains Watershed and Water Quality Laboratory, Durant, Okla.; North Appalachian Experimental Watershed, Coshocton, Ohio; USDA Sedimentation Laboratory, Oxford, Miss.; Grassland, Soil, and Water Research Laboratory, Temple, Tex.; Southwest Rangeland Watershed Research Center, Tucson, Ariz.; Northwest Watershed Research Center, Boise, Idaho; Southern Plains Watershed and Water Quality Laboratory, Chickasha, Okla.; Southeast Watershed Research Laboratory, Tifton, Ga.; Northeast Watershed Research Laboratory, University Park, Pa.; Watershed Research Unit, Columbia, Mo.; and Watershed Research Unit, Council Bluffs, Iowa.

APPENDIX A:
PRINCIPAL STATUTES

PRINCIPAL STATUTES RELATING TO AGRICULTURAL RESEARCH SERVICE ACTIVITIES

Subject or Popular Title	Public Law No.	Approval Date	Purpose
Organic Act of 1862	None	5/15/1862	In addition to establishing the Department of Agriculture, charges the Commissioner of Agriculture with the duty "...To acquire and preserve in his Department all information concerning agriculture which he can obtain by means of books and correspondence, and by practical and scientific experiments,..." This Act initially authorized the Department of Agriculture to perform a research function in relation to agricultural matters. (12 Stat. 387) (7 U.S.C. 2201, 2204)
Domestic Animals and Poultry	---	5/29/84	Establishes Bureau of Animal Industry to investigate and report on the condition of domestic animals and live poultry in the United States and on the causes and means of preventing diseases among them. (23 Stat. 31) (7 U.S.C. 391)
Dairy Industry	68-156	5/29/1924	Authorizes investigations of the dairy industry and dissemination of information for promotion of the dairy industry. (43 Stat. 243) (7 U.S.C. 402)
Dairy and Livestock Industry	69-490	7/3/26	Authorizes Secretary to establish a dairying and livestock experiment station at Mandan, North Dakota, for investigations and experiments in the dairy and livestock industries and for problems pertaining to establishment and development thereof. (44 Stat. 840) (7 U.S.C. 421)
Arboretum	69-799	5/4/27	Authorizes Secretary to establish a national arboretum for purposes of research and education concerning tree and plant life. (44 Stat. 1422) (20 U.S.C. 191-194)

11-864 O - 83 - 10

Subject or Popular Title	Public Law No.	Approval Date	Purpose
Cotton	---	4/12/28	Authorizes Secretaries of Agriculture and Commerce to engage in technical and scientific research on American-grown cotton and its byproducts. (45 Stat. 426) (7 U.S.C. 423)
Dairy Industry	___	5/29/28	Authorizes Secretary to establish a dairy station at Lewisburg, Tennessee, for investigations, experiments, and demonstrations in the dairy industry and the problems pertaining to the dairy industry in the South. (45 Stat. 981) (7 U.S.C. 422)
Cotton Ginning	71-160	4/19/30	Authorizes Secretary to investigate ginning of cotton, to establish and maintain experimental ginning plants and laboratories, and to make tests and technical and scientific studies with respect thereto. (46 Stat. 24) (7 U.S.C. 424)
Soil Conservation Act	74-46	4/27/35	Authorizes Secretary to conduct surveys, investigations, and research relating to the character of soil erosion and the preventive measures needed and relating to economic use and conservation of land. (49 Stat. 163) (16 U.S.C. 590a)
Regional Research Laboratories.	75-430	2/16/38	Authorizes Secretary to establish four laboratories, one in each major farm producing area, to conduct research into and to develop new scientific, chemical, and technical uses and new and extended markets for farm commodities and products and byproducts thereof. (52 Stat. 37) (7 U.S.C. 1292)
Poultry Improvement	78-425	9/21/44	Authorizes Secretary to cooperate with State authorities in the administration of regulations for the improvement of poultry, poultry products, and hatcheries. (58 Stat. 734) (7 U.S.C. 429)

Subject or Popular Title	Public Law No.	Approval Date	Purpose
Substitutes for Strategic Materials	79-520	7/23/46	Authorizes Secretary to make scientific, technologic, and economic investigations of the feasibility of developing domestic sources of supplies of any agricultural material or of using agricultural commodities for the manufacture of any material determined to be strategic and critical. (60 Stat. 599) (50 U.S.C. 98f)
Research and Marketing Act of 1946	79-733	8/14/46	Authorizes Secretary to conduct research into basic laws and principles relating to agriculture; to improve and facilitate the marketing and distribution of agricultural and the development of new and improved methods for the production, marketing, distribution, processing, and utilization of plant and animal commodities at all stages from the original producer to the ultimate consumer; to conduct research in the areas of human nutrition, development of new use and markets for agricultural commodities and agricultural resources (manpower, soil, plants, animals, and equipment); to conduct research relating to conservation, development, and the use of land, forest, and water resources; and authorizes the Secretary to enter into contracts with public or private organizations or individuals when in his judgment the research can be carried out more effectively, more rapidly, or at lower cost than if performed by Department personnel. (60 Stat. 1082) (7 U.S.C. 427, 1621)

Subject or Popular Title	Public Law No.	Approval Date	Purpose
Horse Breeding	80-494	4/21/48	Authorizes Secretary, in connection with transfer of any remount service to the Department, to improve breeding of horses suited to the United States. (62 Stat. 197) (7 U.S.C. 437)
Foot and Mouth Research	80-496	4/28/48	Authorizes Secretary to establish research laboratories and conduct and contract for research of foot-and-mouth and other animal diseases. (62 Stat. 198) (21 U.S.C. 113a)
Cattle Grubs	80-651	6/16/48	Authorizes Secretary to increase and intensify research and investigations into problems and methods relating to the eradication of cattle grubs. (62 Stat. 458) (21 U.S.C. 114c)
Commodity Credit Corporation Charter Act	80-806	6/29/48	Authorizes research relating to the conservation or disposal of commodities owned or controlled by the corporation in collaboration with research agencies of the Department. (62 Stat. 1070) (7 U.S.C. 612c)
Virgin Islands	82-228	10/29/51	Authorizes Secretary to establish, in the Virgin Islands of the United States, an agricultural research and extension service program. (65 Stat. 661) (48 U.S.C. 1409)
Agricultural Trade Development and Assistance Act	83-480	7/10/54	Authorizes the sale of agricultural commodities to friendly countries; authorizes the use of foreign currencies accruing from such sales for a variety of research activities. Sec. 104(b)(1) provides that foreign currency receipts may be used to develop new markets for U.S. agricultural commodities. Sec. 104 (b)(2) provides that foreign

Subject or Popular Title	Public Law No.	Approval Date	Purpose
			currency receipts may be used to collect and disseminate scientific and technologic information, conduct research, and support scientific activities overseas. This Act includes programs of scientific cooperation between the United States and other countries, such as coordinated research against diseases common to all mankind or unique to individual regions. Sec. 104(b)(3) also authorizes support for programs of medical and scientific research, cultural and educational development, family planning, health, nutrition, and sanitation. (68 Stat. 454) (7 U.S.C. 1691)
Research Grants-Basic	85-934	9/6/58	Authorizes Federal agencies to make grants for basic scientific research at nonprofit institutions of higher education or at nonprofit organizations whose primary purpose is the conduct of scientific research. (72 Stat. 1793) (42 U.S.C. 1891)
Humane Slaughter Research	85-765	9/27/58	Authorizes Secretary to conduct, assist, and foster research, investigations, and experimentation to determine and to develop methods of slaughter, and methods for handling livestock in connection with slaughter, that will be humane. (72 Stat. 863) (7 U.S.C. 1904)
Housing Act of 1949	87-70	8/30/61	Authorizes Secretary to conduct research on the adequacy of existing farm housing and on current and prospective needs for farm housing, interrelation of farm housing problems with housing problems of urban and suburban areas, and other matters bearing on the provision of adequate farm housing. (75 Stat. 188) (42 U.S.C. 1476b)

Subject or Popular Title	Public Law No.	Approval Date	Purpose
Cooperative Research Projects	88-250	12/30/63	Authorizes ARS Administrator to enter into agreements and receive funds from State or other political subdivisions, organizations, or individuals. (77 Stat. 820) (7 U.S.C. 450a)
Agricultural Act of 1964	88-297	4/11/64	Authorizes Secretary to conduct a special cotton research program designed to reduce the cost of producing upland cotton in the United States (78 Stat. 174) (7 U.S.C. 14)
Research Grants-Special	89-106	8/4/65	Authorizes Secretary to make grants to State agricultural experiment stations, colleges, universities, and other research institutions and organizations and to Federal and private organizations and individuals for basic and applied research to further the programs of the Department. (79 Stat. 431) (7 U.S.C. 4501)
Tropical Research	89-808	11/11/66	Authorizes Secretary to conduct research in tropical and subtropical agriculture for the improvement and development of tropical and subtropical food products for dissemination and cultivation in friendly countries. (80 Stat. 1537) (7 U.S.C. 1736 (a)(4)
Federal Water Pollution Control Act	92-500	10/18/72	Authorizes Administrator of EPA, in cooperation with other Federal agencies, to develop comprehensive programs for water pollution control, and, in establishing National Programs therefor, to cooperate with other Federal agencies in conducting research, investigations, training, and information programs including, among other things, a comprehensive study and research program for preventing, reducing, and eliminating pollution from agriculture.

Subject or Popular Title	Public Law No.	Approval Date	Purpose
			Administrator of EPA, in consultation with the Secretary of Agriculture, to make grants for research and dissemination of information with respect to methods of preventing and of eliminating pollution from agriculture. (86 Stat. 816) (33 U.S.C. 1151)
Agriculture and Consumer Protection Act of 1973 (Farm Bill)	93-86 (Sec 809)	8/10/73	Authorizes and directs Secretary to carry out a comprehensive study and investigation to determine the reasons for the extensive loss of livestock sustained each year through their subjection to injury and disease during transport in interstate commerce for commercial purposes. Also authorizes and directs Secretary to conduct, in connection with such study and investigation, an intensive research program for the purpose of developing measures that can be taken to reduce materially the number of animals lost through injury and disease during their transport for commercial purposes. (This authority terminated after 4 years.) (87 Stat. 221) (7 U.S.C. 1305)
Agriculture and Consumer Protection Act of 1973 (Farm Bill)	93-86 (Sec 611)	8/10/73	Authorizes and directs Secretary to carry out programs to destroy and eliminate cotton boll weevils in infested areas of the United States and to carry out similar programs with respect to pink bollworms or any other major cotton insect if he determines that methods and systems have been developed to the point that success in eradication of such insects is assured. The Secretary shall carry out, through the Commodity Credit Corporation, the eradication programs authorized by this subsection. In carrying out insect eradication projects, he shall utilize the technical and related

Subject Popular Title	Public Law No.	Approval Date	Purpose
			services of appropriate Federal, State, and private agencies and cotton organizations. (87 Stat. 235) (7 U.S.C. 1305)
Agriculture and Consumer Protection Act of 1973 (Farm Bill)	93-86 (Sec 810)	8/10/73	Authorizes and directs Secretary to carry out regional and national research programs to reduce fertilizer and herbicide usage in excess of production needs, to develop wheat and feed grain varieties more susceptible to complete fertilizer utilization, to improve the resistance of wheat and feed grain plants to disease, and to enhance conservation and environmental qualities. (87 Stat. 238) (7 U.S.C. 1305)
National Arboretum	94-129	11/13/75	Authorizes Secretary to accept, receive, hold, utilize, and administer--on behalf of the United States--gift bequests or devises of real and personal property made for the benefit of the National Arboretum. (89 Stat. 683) (20 U.S.C. 195)
International Development and Food Assistance	94-161 Title II Sec 214	12/20/75	Transfers Farmer-to-Farmer Program from the Secretary of Agriculture to the President. (89 Stat. 849) (22 U.S.C. 2151)
Surface Mining Control and Reclamation Act of 1977	95-87	8/3/77	Sets environmental-protection performance standards to be met at all major surface mining operations for coal; provides for joint responsibility and enforcement by the States and the Federal Government; establishes a self-supporting Abandoned Mine Reclamation Fund to restore land ravaged by uncontrolled mining operations in the past; protects certain land regarded as unsuitable for surface mining; establishes mining and mineral resource institutes and provides

Subject or Popular Title	Public Law No.	Approval Date	Purpose
			funds for coal research laboratories and graduate fellowships; and provides for a transfer of funds to USDA for technical and financial assistance to landowners entering into long-term agreements for reclamation purposes. (91 Stat. 445) (30 U.S.C. 120)
Food and Agriculture Act of 1977 (Farm Bill)	95-113 (Title 14)	9/29/77	Assigns USDA the lead agency role with respect to national food and agricultural science. It also provides for coordination, expanded efforts in priority areas, and widening participation in research and education beyond the USDA and Land Grant University system. The law provides for expansion of USDA involvement in agricultural solar energy research, development, and demonstration, and grants USDA authority to be a full participant in nutrition research and education and in internationally related food and agricultural research and education. Establishes several coordinating and policy committees within USDA (91 Stat. 981) (7 U.S.C. 3101)
Soil and Water Resources Conservation Act of 1977	95-192	11/18/77	Provides that the Secretary shall appraise, on a continuing basis, the soil, water, and related resources of the Nation; develop and periodically update a program for furthering the conservation, protection, and enhancement of the soil, water, and related resources of the Nation; and provides that the President shall transmit periodically, to the Congress, the appraisal of the program as required by this Act. (91 Stat. 1407) (16 U.S.C. 2001)
Clean Water Act of 1977	95-217	12/27/77	Exempts irrigation return flows from the permit system requirements of section 402 of the Federal Water Pollution Control Act of 1972 and

Subject or Popular Title	Public Law No.	Approval Date	Purpose
			defines them as nonpoint sources to be considered in areawide waste treatment management plans. (91 Stat. 1566) (33 U.S.C. 1251)
Surface Mining Control and Reclamation Act of 1977, Amendments	95-343	8/11/78	Authorizes funds for FY 1979 and 1980 for surface mining control and reclamation. (92 Stat. 473) (30 U.S.C. 1302)
Roman L. Hruska Meat Animal Research Center, Nebraska Designation	95-436	10/10/78	Designates the Meat Animal Research Center, located near Clay Center, Nebraska, as the "Roman L. Hruska Meat Animal Research Center." (92 Stat. 1054)
Public Lands Relinquishment of Jurisdiction	95-441	10/10/78	Authorizes Secretary to relinquish exclusive legislative jurisdiction over lands or interests under his control. (92 Stat. 1064) (7 U.S.C. 2268)
Gifts and Property Acceptance and Administration by Secretary of Agriculture	95-442	10/10/78	Authorizes the Secretary to accept and administer, on behalf of the United States, gifts or devises of real and personal property for the benefit of the Department of Agriculture or of any of its programs. (92 Stat. 1065) (7 U.S.C. 2269)
Humane Methods of Slaughter Act of 1978	95-445	10/10/78	Prohibits inhumane slaughtering of livestock within the United States and the importation of any meat or meat products unless such livestock are slaughtered in a humane manner. (92 Stat. 1069) (21 U.S.C. 601)
Carl Hayden Bee Research Center Designation	95-446	10/10/78	Designates the United States Department of Agriculture's Bee Research Laboratory in Tucson, Arizona, as the "Carl Hayden Bee Research Center." (92 Stat. 1071)

Subject or Popular Title	Public Law No.	Approval Date	Purpose
W. R. "Bob" Poage Pecan Field Station, Texas Designation	95-451	10/11/78	Designates the U.S. Department of Agriculture's Pecan Field Station in Brownwood, Texas, as the "W. R. 'Bob' Poage Pecan Field Station." (92 Stat. 1100)
Water Research and Development Act of 1978	95-467	10/17/78	Promotes a more adequate and responsive national program of water research and development. (92 Stat. 1305) (42 U.S.C. 7801)
Food and Agriculture Act of 1977, Amendment (Farm Bill)	95-547	10/28/78	Amends section 1445(b) of the Food and Agriculture Act of 1977 to modify the formula for distribution of funds authorized thereunder for agricultural research. (92 Stat. 2063) (7 U.S.C. 3222)
Native Latex Commercialization and Economic Development Act 1978	95-592	11/4/78	Authorizes the Secretaries of Agriculture and Commerce to coordinate basic and applied research, technology development, and technology transfer leading to effective and economical methods for large-scale culturing of plantations and to the extraction of latex. (92 Stat. 2529) (7 U.S.C. 178)
Energy Security Act	96-294	6/30/80	Authorizes funds to establish the production of synthetic fuels, gasohol, solar energy, renewable resources, and geothermal energy; to establish an energy conservation program and energy supply targets; and to extend the Defense Production Act until September 30, 1986. Title II establishes a comprehensive biomass and alcohol fuels program and urban waste program. Part A of this title contains new programs for USDA, including forestry. Title VII calls for two research programs: (1) Acid Precipitation and (2) Carbon Dioxide. The acid precipitation study sets up an

Subject or Popular Title	Public Law No.	Approval Date	Purpose
			interagency task force jointly chaired by National Oceanic and Atmospheric Administration, EPA, and USDA. The 10-year study includes identifying sources contributing to, monitoring levels of, and formulating recommendations to alleviate acid precipitation. (94 Stat. 611) (42 U.S.C. 8701)
Rural Development Policy Act of 1980 Amendment	96-355	9/24/80	Amends Sec. 2 of the Rural Development Act of 1972 (Public Law 92-419; 86 Stat. 657) by adding a new section, Section 607, which directs the Secretary to assume a leadership role in coordinating a nationwide rural development program by developing a rural development policy, preparing and implementing a rural development program policy, preparing and implementing a rural development strategy and updating it annually, and maximizing coordination of Federal programs affecting rural areas. Reauthorized Title V until 1981. (94 Stat. 1171) (7 U.S.C. 2201)
National Aquaculture Act of 1980	96-362	9/26/80	Provides for a strong national policy statement promoting aquaculture in the United States and calls for the development of a National Plan for Aquaculture, thus encouraging activities and programs in both the public and private sectors of the economy. The bill further provides for studies to investigate the need for financial programs and to examine how we reduce undue regulatory constraints that may face the aquaculture industry. (94 Stat. 1198) (16 U.S.C. 2801)
Animal Cancer Research Act	96-469	10/17/80	Authorizes the Secretary to conduct a program of basic research on cancer in animals and birds at appropriate

Subject or Popular Title	Public Law No.	Approval Date	Purpose
			facilities within USDA, or by grants to other qualified research facilities, and requires consultation and coordination of animal cancer research between the Department of Agriculture and the National Institutes of Health until the end of Fiscal Year 1986. (94 Stat. 2235) (7 U.S.C. 3901)
Stevenson-Wydler Technology Innovation Act of 1980	96-480	10/21/80	Establishes a national policy on the transfer, to local and State governments and to the private sector, of federally funded technology emanating from agencies and laboratories. The law requires each Department to establish, in selected Federal laboratories, an Office of Research and Technology Applications and to mobilize all Federal laboratories in support of technology transfer. (94 Stat. 2311) (15 U.S.C. 3701)
Robert Wentworth Harned Laboratory Designation	97-77	11/13/81	Redesignates the U.S. Department of Agriculture Boll Weevil Research Laboratory, located at Starkville, Mississippi, as the "Robert Wentworth Harned Laboratory." (95 Stat. 1069) (7 U.S.C. 1446)
Agriculture and Food Act of 1981 (Farm Bill)	97-98 (Title XIV)	12/22/81	Extends by four years the Congressional authorization to provide adequate support to funding for research, extension, and teaching aimed at continued gains in the productivity of the agricultural sector. The legislation also provides for strengthening the research and extension partnership between the U.S. Department of Agriculture and the Nation's land- grant colleges and universities. It also expands the scope of activities to include aquaculture, rangeland management, and a Dairy Goat Research Center. Other provisions include authorization for a research extension program

Subject or Popular Title	Public Law No.	Approval Date	Purpose
			concentrating on rural development and small farm problems; establishment of a Soybean Research Advisory Institute within USDA; a requirement that the Secretary of Agriculture include, in a regular annual report due January 1, 1984, a long-term needs assessment for food, fiber, and forest products; a directive to the Secretaries of Agriculture and Health and Human Services to report within 180 days on plans for a human nutrition research and information management system; an authorization for a building fund of $10 million per year for the next five years for the 1890 institutions; a requirement that the Hatch Act be funded at a level at least equal to 25 percent of the funding level for all agricultural research; and a requirement that an Assistant Secretary of Agriculture be appointed to administer the provisions relating to the research, extension, and teaching activities of the Department. (95 Stat. 1213) (7 U.S.C. 1281)

APPENDIX B:
AGRICULTURAL
RESEARCH SERVICE
OFFICES

LOCATION OF HEADQUARTERS, REGIONAL AND AREA OFFICES, AND MAJOR RESEARCH CENTERS

Office of the Administrator, Washington, D.C.
National Program Staff, Beltsville, Md.

NORTHEASTERN REGION Regional headquarters: Beltsville, Md.

Area Offices

North Atlantic Area, Ithaca, N.Y. (includes N.Y., Pa., N.J., Vt., N.H., Maine, Conn., Mass., R.I., Md., Del., and W. Va.)
Beltsville Agricultural Research Center, Beltsville, Md.
Plum Island Animal Disease Center, Orient Point, N.Y.
Eastern Regional Research Center, Wyndmoor, Pa.
Beltsville Human Nutrition Research Center, Beltsville, Md.
Human Nutrition Research Center on Aging, Boston, Mass.

NORTH CENTRAL REGION Regional headquarters: Peoria, Ill.

Area Offices

Illinois-Indiana-Michigan-Ohio Area, Lafayette, Ind.
Dakotas-Minnesota-Wisconsin Area, St. Paul, Minn.
Mid-Great Plains Area, Columbia, Mo. (includes Iowa, Mo., Nebr., and Kans.)
Northern Regional Research Center, Peoria, Ill.
National Animal Disease Center, Ames, Iowa
Grand Forks Human Nutrition Research Center, Grand Forks, N. Dak.

SOUTHERN REGION Regional headquarters: New Orleans, La.

Area Offices

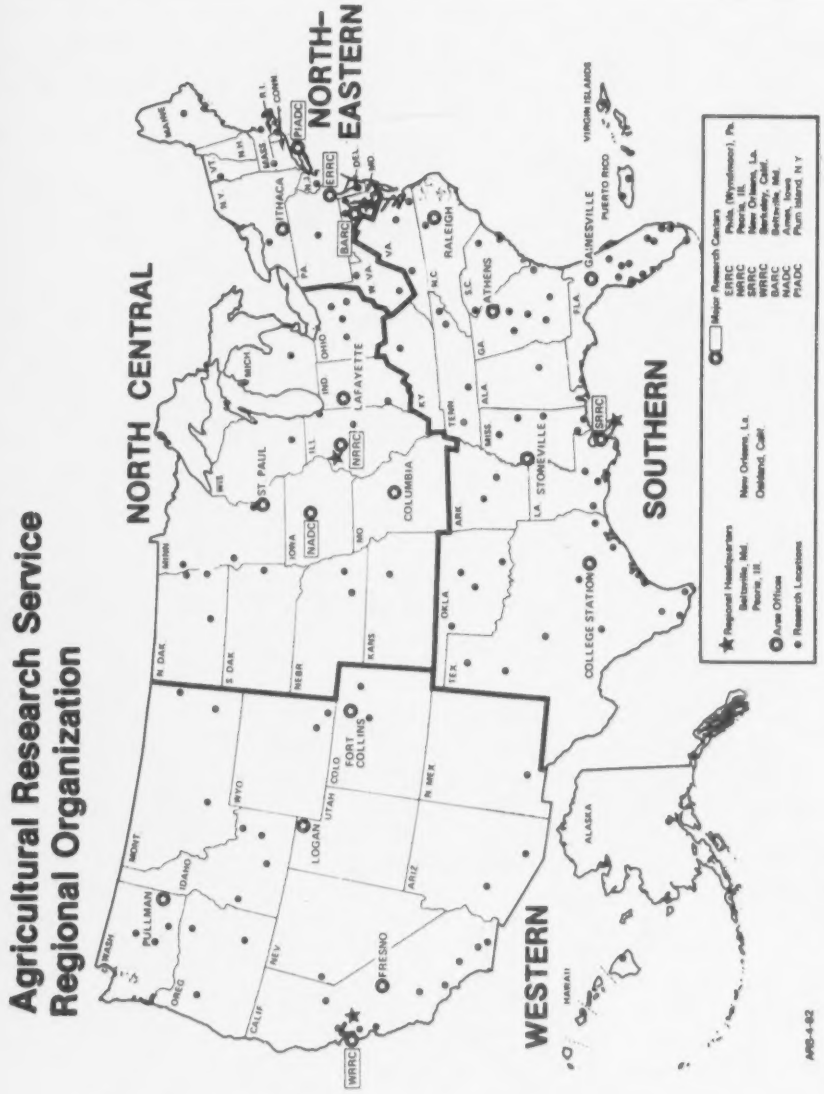
Florida-Antilles Area, Gainesville, Fla. (includes Fla., P.R., and V.I.)
Southeast Area, Athens, Ga. (includes Ga. and Ala.)
Delta States Area, Stoneville, Miss. (includes Miss., La., and Ark.)
Mid-Atlantic Area, Raleigh N.C. (includes N.C., Tenn., Ky., Va., and S.C.)
Oklahoma-Texas, College Station, Tex.
Southern Regional Research Center, New Orleans, La.
Children's Nutrition Research Center, Houston, Tex.

WESTERN REGION Regional headquarters: Oakland, Calif.

Area Offices

California-Hawaii Area, Fresno, Calif.
Rocky Mountain Area, Ft. Collins, Colo. (includes Colo., Wyo., Mont., and Alaska)
Arid Southwest Area, Logan Utah (includes N. Mex., Ariz., Nev., and Utah
Pacific Northwest Area, Pullman, Wash. (includes Oreg., Wash., and Idaho)
Western Region Research Center, Albany, Calif.
Western Human Nutrition Research Center, San Francisco, Calif.

APPENDIX C:
MAP SHOWING MAJOR
ARS LOCATIONS



U.S. GOVERNMENT PRINTING OFFICE: 1982-360-932:SEA-1129

Dr. KINNEY. I might ask Dr. Carter to respond insofar as reorganization of our national program staff, any further comments she may want to make on strategic planning and perhaps she would want to point out some of the additional responsibilities that we have at the national level that do not necessarily relate to the total agricultural research system.

Dr. CARTER. Mr. Chairman, I would like to talk just a moment about the Agricultural Research Service.

In addition to addressing national needs of agriculture in this country, the Agricultural Research Service also has another responsibility within the Department of Agriculture. This is to respond to the research needs of our action and regulatory agencies.

We are responsive to the research needs of the Soil Conservation Service, some of the research needs in pest control to the Forest Service, to the Food Safety and Inspection Service, and to the Animal and Plant Health Inspection Service.

These are national priorities and are important for the safety and health of our agriculture, our people, in this country.

With regard to our national program planning staff, Mr. Chairman, we have realined that and reorganized that to make for more effective program planning.

The reorganization or realinement provides multidisciplinary teams that address broad national problems with leaders who are scientific experts within their own discipline.

I believe those were the main points I wanted to make, Mr. Chairman.

Dr. KINNEY. I might call on Dr. Harris to make any additional comments about the process that is being used to effect the changes as appropriate.

Dr. HARRIS. Well, first a very brief comment that within CSRS itself we do have a fairly intensive review of our staffing needs and roles and we are making adjustments to provide more opportunities for national leadership by the CSRS staff for the total agricultural research program with the cooperating state institutions.

The States themselves will be commenting later. We have witnesses that will be giving you more details on their parts of the program. But I would like to once more state that we do feel that we have a structure that is in place that is providing opportunities for the States to interact amongst themselves and with their Federal partners in the planning and coordination of agricultural research. As you will see in some of the formal responses to the reports that were critical of our planning operations, we were a little disappointed that there was not recognition given to some of the things that we do have in place.

We feel that there is a good interaction and good mechanism for cooperation. It has been working fairly well for us.

Dr. KINNEY. Mr. Chairman, I think to reenforce what Dr. Harris said, we are all very much aware that when a group undertakes a study of an organization, whether it is GAO or OTA or OMB or any other group, they are usually not highly complimentary because they are looking for ways to improve the system.

So I think reports such as those you have alluded to and others can be misinterpreted by people who are not intimately familiar with the system, if they are read in a way that they are looking

only at the criticisms in the report and do not have enough knowledge to look beyond that at what is real with regard to the system.

Mr. SCHEUER. Well, I do not think there is any need for you to be overly defensive about the work that you are doing. Nobody is criticizing USDA. Over the generations you have done an excellent job. Presumably you will continue to do an excellent job.

These three reports seem to establish a pretty clear consensus by able people and knowledgeable people that the job could be done considerably better and that institutionally you are not equipped yet to do the kind of long-term planning and priority setting that would make your work very much more useful and productive.

So nobody is pointing the finger at anybody and saying you are doing a bad job, but apparently there is a feeling that USDA can do a better job. We all could do a better job. I as a Congressman, I am sure, could do a better job; my staff and I are constantly trying to improve our organization and improve our capability. We try not to get wedded to the past and not to have present systems get set in concrete and so forth—and we are not here in any sense of being critical of you. What we are asking you is what has been your response to these three very thoughtful reports that seem to achieve quite a consensus that there could be better planning, better organization, better structural capability for defining implementing long-term goals and integrating the various elements in our national agricultural research capability in industry, agribusiness, universities, and Government. A better job could be done of harnessing and integrating all of these efforts without any revolutions, without mandating to the private sector what it has to do.

The private sector is doing its own research, and that is as it should be. Their's is applied research—with maybe some basic.

But there seems to be a very clear need for a view from the top of the mountain, so to speak, on how we can improve the efficiency and productivity of our entire national agricultural research system.

What we are trying to get at here, with not very much success, is how are you as the top agricultural research official in USDA responding to that. What are your intentions about doing the analysis of these three reports and gleaning the considerable consensus of constructive recommendations that seemingly can come from those reports?

Nobody is criticizing you. These reports are not meant to criticize you. They are meant to help the USDA do its job better and fulfill its mission in a more effective and more imaginative fashion, and there is no need for you to be defensive about it.

Dr. KINNEY. Mr. Chairman, I hasten to add that I do not think we are overly defensive and I think we have accepted these reports in a very opportunistic way.

Mr. SCHEUER. I do not think you mean to use that word—you do not mean opportunistic.

Dr. KINNEY. Yes, sir, perhaps I used the wrong word. What I mean is any time we have a body like OTA or GAO or others——

Mr. SCHEUER. CRS.

Dr. KINNEY. Study a system and make recommendations I have to look at it as an opportunity to improve our system.

Mr. SCHEUER. OK. Can you tell us what you have done to glean from those reports whatever lessons are there to improve your system? What is the process by which you are doing this and what results can be shown from this review and appraisal of those three reports?

Dr. KINNEY. As I indicated, Mr. Chairman, we will submit for the record the written responses that went back. But when a report comes out like this it is studied by the committed people in the Department, these being principally the agency heads. It is studied by the Joint Council, by the Users Advisory Board, surely it is studied by the Office of Management and Budget, the Office of Science and Technology Policy, and others.

We received the responses of these groups and the assessments. We did put together a written response. However, as I said before, the real response is the action that takes place. I think we can submit for the record what I cannot go through in detail here.

I think we can display a pretty good record of how we are responding to specific recommendations.

Mr. SCHEUER. Would you provide the response of these various agencies that you mentioned and then give us some kind of a statement of intentions from you as to how this is all being integrated into a integrated national policy research program for the long term; this is what we are after.

Dr. KINNEY. Fine. As I indicated in the testimony, Mr. Chairman, we in fact do welcome the sort of oversight that groups such as yours provides for us because they do represent an unbiased recommendation from a group that is——

Mr. SCHEUER. A fresh look?

Dr. KINNEY. Yes.

Mr. SCHEUER. We all need that. We all need that to assist us periodically.

We will have some further questions we will submit to you in writing, but I think at this time we have two panels who have been waiting to testify and we will get on to them.

Thank you very much for you testimony, all three of you, and we will look forward to receiving the further information that we have discussed.

Mr. SCHEUER. All right, now let's hear from our first panel, Dr. Charles Kidd, dean of the School of Agriculture, at Florida A&M; Dr. Kenneth Wing of the State Agricultural Experimental Stations, at the University of Maine; and Dr. Handy Williamson, director, cooperative agriculture research program, Tennessee State University.

We are very privileged and honored to have with us this morning, Congressman Fuqua, chairman of the full Science and Technology Committee, and I yield to him to introduce the witnesses.

Mr. FUQUA. Thank you very much, Mr. Chairman, and I first of all want to commend you and the subcommittee for these hearings on the future of agricultural research, and it is another pleasure to introduce my good friend, Dr. Charles Kidd, who is the dean of the College of Engineering, Sciences, Technology, and Agriculture at Florida A&M University in Tallahassee. He has had a very interesting background in many, many varied fields and has brought a

great deal of credit not only to Florida A&M but also to the college of which he is the dean.

So it is a great pleasure to see my good friend, Dr. Kidd, here today and to weigh his testimony—if I do not have to go to the Rules Committee.

Mr. SCHEUER. With that, why don't we start off with your testimony, Dr. Kidd. Take whatever time you need to give us the highlights of your testimony. For all three of you, let me say that your testimony will be printed in full as you prepared it at this point in the record, so perhaps you could take 8 or 10 minutes or whatever you need to chat with us informally and then after the three of you have had a chance to express your views, I am sure we will have some questions for you.

STATEMENTS OF CHARLES C. KIDD, DEAN, SCHOOL OF AGRICULTURE, FLORIDA A&M UNIVERSITY; KENNETH WING, STATE AGRICULTURAL EXPERIMENTAL STATIONS, UNIVERSITY OF MAINE; AND HANDY WILLIAMSON, DIRECTOR, COOPERATIVE AGRICULTURE RESEARCH PROGRAM, TENNESSEE STATE UNIVERSITY

Dr. KIDD. I would like to thank you very much for the opportunity to address this committee on a matter that I think is extremely important to us all and certainly important to us at Florida A&M University.

The world suddenly became aware of an emerging food crisis in the 1970's, when, after more than two decades of steady yearly increases, worldwide food production dropped almost 2 percent. The immediate cause of this drop was bad weather in various parts of the world; however, several critical factors became quite evident at home and abroad:

There is a close link between energy and agriculture. Modern U.S. agriculture with its emphasis on machines, fertilizers, pesticides, and hybrid seeds is an energy consumer of very high magnitude. Because of declining reserves of fossil fuels, agriculture in general and the fertilizer industry in particular, are faced with high energy prices.

In my opinion, this problem may continue in the 1980's and even in early 1990's, until appropriate technology is available to use alternative sources of energy.

Shortage of freshwater in many parts of the United States has already reached a crisis stage. In my own home State of Florida, the levels of freshwater lakes are dropping every year. South Florida has been facing water shortage for almost 5 years now. Under such conditions, water for irrigating grain and fruit crops is hard to obtain.

It seems that several crops in the United States have reached their yield maxima. In the 1960's and early 1970's, crops responded favorably to application of fertilizers. However, the response has decreased to a minimum in the recent years. Research on new crops as well as new varieties of crops is needed that will continue to respond to the application of fertilizers.

Millions of acres of agricultural land are being lost every year in the United States due to soil erosion, poor soil management, and

real estate development. The price of good agricultural land has increased manyfold. This has especially hurt the small farm operators, who can no longer afford to buy or maintain a farm. Land grant universities, in cooperation with the U.S. Department of Agriculture and Soil Conservation Service, need to intensify their research efforts relative to this pressing problem.

Recent events related to the Mediterranean fruit fly have shown us the vulnerability of our food and fruit crops. Research is needed not only in treating the infested crops but more so in trying to find ways to prevent and control such pest infestations.

As we use new chemicals, fertilizers and pesticides, to increase crop yields, long-term research is needed to assess their impact on our total environment.

Land grant universities have been involved in agricultural research and extension since 1862. The 1890 institutions, predominantly black land grant universities, even though they received their land grant status almost 100 years ago, did not receive any Federal or State funds to conduct agricultural research and extension services until 1973. The passage of Public Law 95-113, section 1445, now known as Evans-Allen funds, for the first time gave us an opportunity to actively participate in solving the Nation's agricultural problems.

Florida A&M University along with 16 other 1890 institutions in various States is involved in long-range agricultural research programs. The information shown in table No. 1 reveals the current funding levels of agricultural research at these institutions. Various areas of research at 1890 institutions can be categorized as human nutrition research; rural development research; animal science research; and soil and plant research.

A main objective of agricultural research, and extension services at 1890 institutions is to help the low-income, limited resource farmers and small acreage operators. This will continue. The improvement of small-acreage farm operations in areas such as production, marketing, and economics should be a national priority as these resources represent a significant percentage of our national agricultural productivity.

Research efforts are needed in areas of nutrition, improvement of crop plants, reclamation of waste lands, and prevention of pollution.

The true capacities of 1890 land-grant institutions to conduct meaningful agricultural research which contributes to the solution of some of the long-term productivity problems enumerated can only be credibly assessed if one reviews the formative events in our recent pasts. The preparatory strategic and political developments and the enactment of Public Law 95-113 signaled the beginning of an era during which 1890 land-grant institutions were supposed to emerge from their respective ancillary research and extension roles as significant partners on the U.S. and State agricultural teams performing research and service which contributed to resolution of food-related problems.

Steps were taken in some instances to realize this level of productive cooperation. However, the consideration and passage of Public Law 95-113 seemed to have had a catalytic effect on ongoing efforts under State desegregation plans to eliminate "unnecessary"

duplication of programs in historically white and black universities.

The weight of the ax of elimination fell hard on the smaller historically black land-grant institutions resulting in the loss of agricultural and nutrition programs and the specialized research-oriented faculty that staffed these programs. Ironically, our response to this onslaught has positively modified, at least disciplinarily, our capacities to conduct agricultural research.

Organizationally and functionally we became of necessity interdisciplinary in our agricultural research efforts. By any analysis, national food problems are not strictly agricultural production problems. They are complex variables of agricultural production practices, environmental factors, and the econo-technical infrastructure.

In terms of research manpower the 1890 land-grant institutions and Tuskegee represent a cadre of over 500 biological, physical, social, engineering, and agricultural scientists who are well prepared to conduct beneficial and conclusive agricultural research. These scientists comprise approximately 4 percent of the agricultural scientific work force. The total capacity of 1890 land-grant institutions to continually contribute to the solutions of national agricultural problems could be greatly enhanced through an improved system of funding 1890 agricultural research which provides an adequate base and allows for adjustment and redirection of funds not expended due to biological and climatogical factors.

Moreover, a Federal impetus for the development of modern graduate programs in agriculture at 1890 institutions would significantly improve research efforts and assure the expansion and replenishment of the very productive pool of black agricultural research scientists, 95 percent of whom are graduates of 1890 institutions.

Our national food problems are significant but only a part of the world's nutrition and agricultural problems. On this global scale agricultural problems are largely those of small farmers and other managers of small acreage systems. Many keen observers have noted the congruence of the 1890 expertise and experience within this realm of problem solving. However, to date only nine 1890 institutions are involved in international agricultural research whereas, the members of the U.S. universities with prime agricultural research contracts exceeds 120.

Efforts to improve this situation are currently underway but need bolstering. To the extent that our 1890 scientists are not involved in Africa and the Caribbean they represent a wasted American resource.

Florida A&M University, similar to other 1890 land-grant institutions, is in a unique position, not only geographically but also traditionally, to make a significant contribution in agricultural instruction research, and extension activities meeting the needs of limited resource farmers. Several past and present projects funded by CSRS, U.S. Department of Agriculture, have made significant contributions and have had a direct impact on small farm operation and rural life in general.

These projects include: Nutritional diets for senior citizens, vegetable production on small acreage farms; pasture management;

cow/calf operation; experimental low-cost housing; and farm marketing and grape production as a "pilot commodity" for small farmers in the State of Florida.

In 1978, the legislature, responding to the needs of Florida's grape growers, provided funds to establish a Center for Viticultural Science at Florida A&M University. This ongoing program is involved in grape research and production practices beneficial to small farm operators.

Since 1975, the FAMU Cooperative Extension Service unit has received support from the USDA to provide services to limited resource farms and their owners in an effort to alleviate problems inhibitory to their economic viability. This service has been a joint effort between FAMU and the University of Florida-IFAS Extension Service, with most of the efforts being performed off campus directly in the farmer's field.

To date, more than 2,500 farmers have been served. Currently, this specific service is provided only in six counties located in central and northwest Florida—Columbia, Gadsden, Jackson, Leon, Manatee, and Sumter—because of limited funding. Many more needy farmers have not received any services.

Florida A&M University and other 1890 land grant institutions have unexhausted capacities to participate in agricultural research designed to solve a variety of problems and to provide the Nation's long-term agricultural needs.

I would like to thank you for the opportunity to present this testimony. I hope that I can answer any questions that you might have.

[The prepared statement of Dr. Kidd follows:]

Statement

of

Dr. Charles C. Kidd, Sr.

Dean, College of Engineering, Technology

and Agriculture

Florida A&M University
Tallahassee, FL 32307

Before the

Subcommittee on Natural Resources

Agriculture Research and Environment

of the

Committee on Science and Technology

U.S. House of Representatives

Introduction

Good morning. I am Dr. Charles C. Kidd, Dean of the College of Engineering Sciences, Technology, and Agriculture, Florida Agricultural and Mechanical University, Tallahassee, Florida. It it a privilege to appear before you today to respond on a matter of such vital importance as the Nation's long-term agricultural research needs.

Background

The world suddenly became aware of an emerging food crisis in 1970's, when, after more than two decades of steady yearly increases, worldwide food production dropped almost 2 percent. The immediate cause of this drop was bad weather in various parts of the world, however, several critical factors became quite evident at home and abroad:

1. Increase in Price of Energy

There is a close link between energy and agriculture. Modern U.S. agriculture with its emphasis on machines, fertilizers, pesticides, and hybrid seeds is an energy consumer of very high magnitude. Because of declining reserves of fossil fuels, agriculture in general and fertilizer industry in particular, are faced with high energy prices. In my opinion, this problem may continue in the 1980's and even in early 1990's, until appropriate technology is available to use alternative sources of energy.

2. Shortage of Fresh Water

Shortage of fresh water in many parts of the United States has already reached a crisis stage. In my own home state of Florida, the levels of fresh water lakes are dropping every year. South Florida has been facing water shortage for almost 5 years now. Under such conditions, water for irrigating grain and fruit crops is hard to obtain.

3. Levelling-off of Yields

It seems that several crops in the U.S. have reached their yield maxima. In the 60's and early 70's, crops responded favorably to application of fertilizers. However, the response has decreased to a minimum in the recent years. Research on new crops as well as new varities of crops is needed that will continue to respond to the application of fertilizers.

4. Loss of Agricultural Land

Millions of acres of agricultural land are being lost every year in the U.S. due to soil erosion, poor soil management and

real-estate development. The price of good agricultural land has increased manyfold. This has especially hurt the small-farm operators, who can no longer afford to buy or maintain a farm. Land-Grant universities in cooperation with U.S. Department of Agriculture and Soil Conservation Service need to intensify their research efforts relative to this pressing problem.

5. New Ways to Control Insect Pests

Recent events related to the Mediterranean fruit fly have shown us the vulnerability of our food and fruit crops. Research is needed not only in treating the infested crops but more so in trying to find ways to prevent and control such pest infestations.

6. Environmental Concerns

As we use new chemicals, fertilizers and pesticides, to increase crop yields, long-term research is needed to assess their impact on our total environment.

Agricultural Research at the 1890 Institutions

Land-Grant Universities have been involved in agricultural research and extension since 1862. The 1890 institutions, predominantly black land-grant universities, eventhough they received their land-grant status almost a hundred years ago, did not receive any federal or state funds to conduct agricultural research and extension services until 1973. The passage of P.L. 95-113, Section 1445, now known as Evans-Allen Funds, for the first time gave us an opportunity to actively participate in solving

the nation's agricultural problems. Florida A&M University along with 16 other 1890 institutions in various states is involved in long-range agricultural research programs. The information shown in table #1 reveals the current funding levels of Agricultural Research at these institutions. Various areas of research at 1890 institutions can be categorized as Human Nutrition Research; Rural Development Research; Animal Science Research; and Soil and Plant Research. (Table #1 on next page).

A main objective of agricultural research, and extension services at 1890 Institutions is to help the low-income, limited-resource farmers and small-acreage operators. This will continue. The improvement of small-acreage farm operations in areas such as production, marketing and economics should be a national priority as these resources represent a significant percentage of our national agricultural productivity.

Research efforts are needed in areas of nutrition, improvement of crop plants, reclamation of waste lands and prevention of pollution.

The true capacities of 1890 Land-Grant Institutions to conduct meaningful agricultural research which contributes to the solution of some of the long-term productivity problems enumerated can only be credibly assessed if one reviews the formative events in our recent pasts. The preparatory stategic and political developments and the enactment of public law 95-113 signaled the beginning of an ERA during which 1890 Land-Grant Institutions were supposed to emerge from their respective ancillary research and extension roles and as significant partners on the U.S. and

Table 1

1890 Land-Grant Colleges

		FY 1982 Agricultural Research Allocation
1.	Alabama A&M University, Alabama	$ 1,256,965
2.	Alcorn State University, Mississippi	1,307,540
3.	Delaware State College, Delaware	433,427
4.	Florida A&M University, FLorida	852,410
5.	Fort Valley State College, Georgia	1,353,215
6.	Kentucky State University, Kentucky	1,509,786
7.	Langston University, Oklahoma	973,233
8.	Lincoln University, Missouri	1,394,864
9.	North Carolina A&T State University, North Carolina	1,956,892
10.	Prairie View A&M University, Texas	1,880,435
11.	South Carolina State College, South Carolina	1,091,155
12.	Southern University, Louisiana	995,265
13.	Tennessee State University, Tennessee	1,482,932
14.	University of Arkansas (Pine Bluff), Arkansas	1,083,707
15.	University of Maryland (Eastern Shore), Maryland	724,119
16.	Virginia State University, Virginia	1,284,806
17.	Tuskegee Institute, Alabama	1,237,289
	Sub-total	20,818,040

state agricultural teams performing research and service which contributed to resolution of food related problems. Steps were taken in some instances to realize this level of productive cooperation. However, the consideration and passage of P.L. 95-113 seemed to have had a catalytic effect on on-going efforts under state desegregation plans to eliminate "unnecessary" duplication of programs in historically white and black universities. The weight of the axe of elimination fell hard on the smaller historically black land-grant institutions resulting in the loss of agricultural and nutrition programs and the specialized research-oriented faculty that staffed these programs. Ironically, our response to this onslaught has positively modified, at least disciplinarily, our capacities to conduct agricultural research. Organizationally and functionally we became of necessity interdisciplinary in our agricultural research efforts. By any analysis, national food problems are not strictly agricultural production problems. They are complex variables of agricultural production practices, environmental factors and the econo-technical infrastructure. In terms of research manpower the 1890 Land-Grant Institutions and Tuskegee represent a cadre of over 500 biological, physical, social, engineering and agricultural scientists who are well prepared to conduct beneficial and conclusive agricultural research. These scientists comprise approximately 4% of the agricultural scientific work force. The total capacity of 1890 Land-Grant Institutions to continually contribute to the solutions of national agricultural problems

could be greatly enhanced through an improved system of funding 1890 agricultural research which provides an adequate base and allows for adjustment and redirection of funds not expended due to biological and climatogical factors. Moreover, a federal impeteus for the development of modern graduate programs in agriculture at 1890 institutions would significantly improve research efforts and assure the expansion and replentishment of the very productive pool black agricultural research scientists (95% of whom are graduates of 1890 institutions).

Our national food problems are significant but only a part of the world's nutrition and agricultural problems. On this global scale agricultural problems are largely those of small farmers and other managers of small acerage systems. Many keen observers have noted the congruence of the 1890 expertise and experience within this realm of problem solving. However, to-date only nine 1890 institutions are involved in international agricultural research whereas, the members of U.S. universities with prime agricultural research contracts exceeds 120. Efforts to improve this situation are currently underway but need bolstering. To the extent that our 1890 scientists are not involved in Africa and the Caribbean they represent a wasted American resource.

Florida A&M University, similar to other 1890 Land-Grant Institutions, is in a unique position, not only geographically but also traditionally, to make a significant contribution in agricultural institution, research, and extension activities meeting the needs of limited resource farmers. Several past and present projects funded by CSRS, U.S. Department of Agriculture, have made

significant contributions and have had a direct impact on small-farm operation and rural life in general. These projects include: Nutritional diets for senior citizens; Vegetable production on small-acreage farms; Pasture management; Cow/Calf operation; Experimental low-cost housing; and Farm marketing and grape production as a "Pilot Commodity" for smallfarmers in the State of Florida.

In 1978, the Legislature, responding to the needs of Florida's grape growers, provided funds to establish a Center for Viticultural Science at Florida A&M University. This ongoing program is involved in grape research and production practices beneficial to small-farm operators.

Since 1975, the FAMU Cooperative Extension Service unit has received support from the USDA to provide services to limited resource farms and their owners in an effort to alleviate problems inhibitory to their economic viability. This service has been a joint effort between FAMU and University of Florida-IFAS Extension Service, with most of the efforts being performed off-campus directly in the farmer's field. To date, more than 2,500 farmers have been served. Currently, this specific service is provided only in six counties located in central and northwest Florida (Columbia, Gadsden, Jackson, Leon, Manatee and Sumter) because of limited funding. Many more needy farmers have not received any services.

Florida A&M University and other 1890 Land-Grant Institutions have unexhausted capacities to participate in agricultural research designed to solve a variety of problems and to provide the nation's long-term agricultural needs. Thank you.

Mr. SCHEUER. Very good. We appreciate your very thoughtful testimony.

I am sure we will have some questions for you when the other witnesses have completed their remarks.

Dr. Williamson.

Dr. WILLIAMSON. Thank you, Mr. Chairman.

I have with me a brief, four-page statement for the record that I would like to read.

Mr. SCHEUER. Fine.

Dr. WILLIAMSON. I am honored today to appear before you and to speak on behalf of the world's greatest research and development program, America's land-grant system. I am Handy Williamson, Jr., director of the cooperative agricultural research program, and associate professor of rural development at Tennessee State University in Nashville, Tenn.

I am here today to speak on behalf of the Evans-Allen program, formerly known as the 1890 land-grant institutions and Tuskegee Institute research program. We in the 1890 universities are proud of our growing participation in the land-grant programs of our respective States and of our increasing role in international development assistance.

I appear before you today in place of Dr. O. C. Simpson, the chairman of our Association of Research Directors, because Dr. Simpson is abroad on an international development project.

As spokesman for the group of historically black land-grant universities known as the 1890's, I hope to convey some of the unique perspectives that we bring to bear upon American agriculture. We are the stepchildren of the land-grant system, having never been sufficiently funded. Until recent years, virtually no research moneys were available to us.

Our poverty status included our clientele, and our students who had grown up on small marginal farms and tenant farms. We were and remain close to this clientele. Most of the small farm research carried out in the United States is conducted at our schools. We are people oriented and the people we serve are many of the Nation's poorest rural residents, many of whom are former farmers who have been forced off the land.

Hybrid corn, artificial insemination, penicillin, and just recently, the cloning of calves, are all products of this system known as land grant. Yet, ironically, like the proverbial prophet without honor in his own land, the benefits of this system may be most fully appreciated only by less fortunate countries of this world.

Our agency for international development and governments of developing nations look to the U.S. land-grant model as they establish programs of agricultural research, teaching, and extension. In these countries, such activities are national priorities.

In my written comments I tried to make a distinction between food policy and agriculture research policy.

The distinction between American agriculture and food as subjects is an important one. Failure to make this distinction has led to many policy confusions and to some of our current preoccupation with our continued ability to meet our domestic and international food production needs over the next 20 years.

11-864 O - 83 - 12

Addressing the needs of the isolated special interest groups of our agricultural sector singularly may do little or nothing to help insure an adequate food supply. An example of this might be Federal measures designed to help groups of farmers with Federal price supports. Such measures may or may not help these farmers, but they may encourage farmers to grow unneeded crops and do nothing to encourage those crops which are most needed.

The second reason I find the distinction between agriculture and food to be a vital one in Federal policy considerations is that without a clear national food policy, we continue to concern ourselves with economic forces within the agricultural industry, rather than with the consumers' food supply. We need a food policy to insure a food supply. Without a food policy, agricultural research cannot fully help meet food supply and production needs.

In the light of such national food policies, the entire land-grant system could be mobilized to conduct the research needed to reach these national goals.

Because the production, marketing, and distribution of food in the United States impacts upon and is affected by elements of the economy as diverse as our very landscape in the great State of Tennessee, a national food policy must embrace a broad group of Federal and State policies. To insure such coordination, a national advisory board composed of the Secretaries of Agriculture, Commerce, Treasury, State, and Transportation; land-grant representatives; and representatives of the private sector should be established.

Finally, and first in importance, food is produced by and for people. Major economic hardship has already been placed on many of our rural residents displaced by modernized farming practices. I do not think anyone here wants our crops planted and harvested by robots. Neither do we like being treated as robots when we shop in supermarkets filled with vegetables developed for their pretty shapes and hardy skins so that they can be packaged without spoilage. We as consumers are entitled to fresh foods rich in taste and nutrients, grown nearby, under conditions that insure maximum local employment. An adequate food supply then is much more than yield per acre.

With the development of a policy to promote an adequate food supply, overseen by Cabinet members and Congress, the food supply system would not be bartered with, used as a pawn in foreign affairs, or only championed by our farm belt Senators and Congressmen. It therefore seems, properly, everybody's business and in everybody's interest.

The land-grant institutions have built and maintained for over a century the broadest agricultural network in America. Its relationships include representatives of every segment of American agriculture—farmers, marketing associations, trade associations, international trade groups, State and Federal officials and consumer groups. Moreover, the land-grant schools have the greatest research capacity and potential for conducting the research necessary to resolve long-term productivity of any research cluster in America.

We are the link between farmers, Government, and the people. Yet our potential is still unrealized, because we are inadequately

funded and because clear and comprehensive Federal policies have not been developed. The Nation needs comprehensive policies and goals directed toward specific production, processing, transportation, wholesaling, and retailing of a well-defined food supply.

I feel the land-grant university can play a major role in shaping Federal policies and goals.

The agriculture industry is composed of such diverse—and not always harmonious—groups, that meaningful policies must consider each of these components and balance their varied interests—and balance them in a manner consistent with national food needs. The members of the land-grant universities are uniquely qualified to insure that each of these components and component interests is reconciled.

We in the land-grant system are also aware that the elements are so diverse and potentially divisive that strong leadership is required to compel various economic interests to direct their energies and expenditures in a manner consistent with domestic and international food needs in this century.

We, the representatives of the land-grant system, are circumscribed in our authority and our missions by the Congress. And we are all aware that among the fundamental issues facing agriculture is land use, yet such fundamental and vital issues affecting our future capacity for food production must be addressed in broader arenas than agriculture. The same is true of most of the major impediments to our agricultural production, impediments such as tight money and high interest rates.

We are prepared to help develop the needed national policies and goals, but to be meaningful, we need the broadest possible mandate from Congress, and its fullest support.

I believe that the capacity for conducting the research needed for the next 20 years is essentially there in the land-grant system. I believe that with the support from Congress the land-grant university can address that need.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Williamson follows:]

STATEMENT OF DR. HANDY WILLIAMSON, JR., DIRECTOR OF THE COOPERATIVE AGRICULTURAL RESEARCH PROGRAM, TENNESSEE STATE UNIVERSITY, NASHVILLE, TENN.

I am honored today to appear before you and to speak on behalf of the world's greatest research and development program—America's land-grant system. I am Handy Williamson, Jr., director of the cooperative agricultural research program and associate professor of rural development at Tennessee State University in Nashville, Tennessee.

I am here today to speak on behalf of the Evans-Allen program, formerly known as the 1890 land-grant institutions and Tuskegee Institute research program. We in the 1890 universitites are proud of our growing participation in the land-grant programs of our respective States and of our increasing role in international development assistance. I appear before you today in place of Dr. O. C. Simpson, the chairman of our association of research directors, because Dr. Simpson is abroad on an international development project.

As spokesman for the group of historically-black land-grant universitites known as the 1890s, I hope to convey some of the unique perspectives that we bring to bear upon American agriculture. We are the step-children of the land-grant system, having never been sufficiently funded. Until recent years, virtually no research monies were available to us. Our poverty status included our clientele, and our students who had grown up on small marginal farms and tenant farms. We were and remain close to this clientele. Most of the small farm research carried out in the United States is conducted at our schools. We are people-oriented and the people we

serve are many of the nation's poorest rural residents, many of whom are former farmers who have been forced off the land.

The nature of our history and our traditional clientele give us a special perspective on the nation's agriculture system because we see much of this system as it affects the rural poor. We are also conducting basic research and our program scientists represent diverse academic departments, not confined solely to the schools of agriculture and home economics. Our basic research capacity has been severely limited by our long neglect. Recognizing this, Congress recently approved a measure for upgrading our physical facilities so that we can provide modern laboratories and equipment for our scientists.

As we move closer to the next century, this country and its land-grant system face monumental challenges that are only dimly perceived by the American public. We have taken our food supply for granted for too long.

If food is America's best buy—and it is; Americans spend a smaller portion of their incomes for food than do any other people in the world. If food is our best buy, agricultural research is our best public investment. Each public dollar spent on agricultural research returns $4 to the national economy.

Hybrid corn, artificial insemination, penicillin, and just recently, the cloning of calves, are all products of this system known as land-grant. Yet, ironically, like the proverbial prophet without honor in his own land, the benefits of this system may be most fully appreciated only by less fortunate countries of this word. Our agency for international development and governments of developing nations look to the U.S. land-grant model as they establish programs of agricultural research, teaching, and extension. In these countries, such activities are national priorities.

When we were struck by an oil embargo, our people and our economy went into a shock from which neither has recovered. We had taken our supply of abundant and low-cost oil for granted for so long that early warning about our increasingly dangerous dependence of foreign oil were ignored. Should this country find itself with a food shortage, the conseqences would be far more dire than the oil shortage. And unless and until this country grapples with the critical issues facing our agricultural community, all other national priorities will be built upon sand.

As an anonymous sage reminded us: "Man—despite his artistic pretensions, his sophistication, and his many accomplishments—owes his existence to a six-inch layer of topsoil and the fact that it rains."

A former Secretary of Agriculture warned the President: "We have unmistakably reached the period where we must think and plan . . . we have been so bent on building up great industrial centers by every natural and artificial device that we have had little thought for the very foundations of our industrial existence." The warning note was sounded in 1913. It has gone unheeded for nearly 70 years.

Since then, that six-inches of topsoil exits in fewer places as our population grows. Population increases alone are less a threat to our food supply than where our population lives, however. Subdivisions and shopping centers continue to proliferate atop some of our finest remaining topsoil, despite repeated warnings over the years by agriculturalists.

The problem of competing demands for farmland must be addressed by the administration and this august body, the Congress, as part of a comprehensive and long-range strategy for ensuring the future of our food supply for domestic consumption and export.

I focus my comments on food for two important and often neglected reasons. First, we in agricultural research and this committee are properly concerned with an adequate food supply for our people and people in other countries as well. Agriculture is the institution, but it is the primary product of agriculture with which we should never lose sight. That product is food.

The distinction between American agriculture and food as subjects is an important one. Failure to make this distinction has led to many policy confusions and to some of our current preoccupation with our continued ability to meet our domestic and international food production needs over the next 20 years.

Addressing the needs of the isolated special interest groups of our agricultural sector singularly may do little or nothing to help ensure an adequate food supply. An example of this might be federal measures designed to help groups of farmers with federal price supports. Such measures may or may not help these farmers. But they may encourage farmers to grow unneeded crops and do nothing to encourage those crops which are most needed.

The second reason I find the distinction between agriculture and food to be a vital one in Federal policy considerations is that without a clear national food policy, we continue to concern ourselves with economic forces within the agricultural industry, rather than with the consumers' food supply. We need a food policy to insure a food

supply. Without a food policy, agricultural research cannot fully help meet food supply and production needs.

To direct and refine agricultural research in this country, national food goals must be established. To be meaningful, such goals should be accorded the priority they warrant. We are still suffering from the after shocks of the oil embargo, yet the oil crisis would be rendered almost trivial in the face of a food supply crisis in the United States.

In the light of such national food policies, the entire land-grant system could be mobilized to conduct the research needed to reach these national goals.

Because the production, marketing, and distribution of food in the United States impacts upon and is affected by elements of the economy as diverse as our very landscape in the great State of Tennessee, a national food policy must embrace virtually every sector of Federal and State policies. To ensure such coordination, a national advisory board composed of the secretaries of agriculture, commerce, treasury, state, and transportation; land-grant representatives; and representatives of the private sector should be established.

Land use, cropping practices, water supplies, federal finances, and the various well-known and well-documented threats to our food supply could be comprehensively addressed. Certainly such policy would encourage the regional production, transportation, and marketing of food rather than our continued reliance of trans-continental transportation of our domestic food supply.

Certainly crop diversification would be encouraged and prime farmland protected. Such national policy would work to ensure a harmonious relationship among nutritionists and plant and animal scientists. One element of agriculture cannot be played against another. The definition of adequate food supply must consider nutritional sufficiency. We do not want to simply eat bread and take comfort in our export sales of grains if we can't afford a tomato. If our diets are too rich in some foods and too lean in others, federal policy should encourage both the production and consumption of foods to redress both our diets and our food production system.

Finally, and firstly in importance, food is produced by and for people. Major economic hardship has already been placed on many of our rural residents displaced by modernized farming practices. I do not think anyone here wants our crops planted and harvested by robots. Neither do we like being treated as robots when we shop in supermarkets filled with vegetables developed for their pretty shapes and hardy skins so that they can be packaged without spoilage. We as consumers are entitled to fresh foods rich in taste and nutrients, grown nearby, under conditions that insure maximum local employment. An adequate food supply then is much more than yield-per-acre.

With the development of a policy to promote an adequate food supply, overseen by cabinet Members and Congress, the food supply system would not be bartered with, used as a pawn in foreign affairs, or only championed by our farm belt Senators and Congressman. It therefore becomes, properly, everybody's business and in everybody's interest.

It is a challenge to this committee, to this Congress, to this administration, to create this policy and elevate it to the highest councils in the land.

Now I'd like to say something about research, now that we have established a meaningful context for research. We at the 1890 universities are eager to serve in the research efforts necessary to the considerable task of providing for an adequate food supply. With the help of provisions contained in the 1981 farm bill designed to help us modernize our laboratories, we hope to contribute more basic research.

Our legacy of privation—neither research laboratories nor research money until very recently—and our heritage of training disadvantaged rural black youths, of responding to community needs among our dwindling number of black farmers—has enabled us to see first-hand the effects of federal policies on our rural residents, the effects of mechanization and high interest rates on the small farmer, and the growing number of former farmers.

So it is with considerable pride that I can report that we at the 1890 universities are and have been conducting a large share of the small farm research in this country. Development of a hybrid corn that yielded 1,000 bushels per acre would not affect our marginal farmers, our part-time farmers, or most of our rural poor. Community development would help. So would cooperative marketing opportunities. In many cases, a mule would help more marginal farmers than a new combine. Such modest and inexpensive efforts to help these farmers would also help them and their communities—plagued by unemployment and scant community resources—become more self-sufficient.

The feasibility of such strategies is an appropriate arena for research, and one which our land-grant universities, including the expertise of our extension person-

nel—are eminently qualified to conduct. Working within the land-grant system has always involved working closely with farmers, and this means close ties to the people affected by research and by the countless policies affecting them in both the public and private sectors. In short, we are not isolated from our clientele. "No ivory tower research conducted here" could adorn the research facilities of any land-grant university.

This strength should be taken into account in research strategy designed to help realize the much-needed national food policy.

But our contact with the real world of farming does not mean we slight the basic sciences. We at the 1890's have considerable distances to travel before we approach the sophistication of the laboratories at the 1862 universities, but we are moving to increase this capacity. Currently at Tennessee State University in Nashville, our research program includes scientists representing not only the school of agriculture and home economics, but also the departments of bilogical science, economics sociology, social welfare, history, civil engineering, and collaborative research with scientists throughout the southeast, at both 1890 and 1862 stations. We at Tennessee State University work together with the University of Tennessee in Knoxville on annual reviews of research needs in Tennessee.

There has been criticism of this land-grant system, and we are not above such criticism. Certainly more basic research is desirable, and certainly nationally focused research is needed. But as I suggested earlier, research needs and research methods cannot be evaluated and modified sensibly in the absence of clear and strong national policies that consider the broader issues of governmental actions that indirectly and negatively impact our system of food production. Economic forces beyond the amelioration of the research network and beyond the power of the U.S. Department of Agriculture will continue to affect agriculture more strongly than any other element. For this reason, the total resources of the Federal government must be applied to the development and maintainence of a food policy to ensure that your children and mine will not face hunger in their lifetimes.

With the foregoing background, I'd like to briefly and directly attempt to answer the two specific questions this committee asked me to address.

The first concerns the capacity of the land-grant colleges and universities to conduct the research necessary to resolve long-term agricultural productivity problems.

The land-grant institutions have built and maintained for over a century the broadest agricultural network in America. Its relationships include representatives of every segment of American agriculture—farmers, marketing associations, trade associations, international trade groups, State and Federal officials, and consumer groups. Moreover, the land-grant schools have the greatest research capacity and potential for conducting the research necessary to resolve long-term productivity of any research cluster in America.

We are the link between farmers, government, and the people. Yet our potential is still unrealized, because we are inadequately funded and because clear and comprehensive federal policies have not been developed. The Nation needs comprehensive policies and goals directed toward specific production, processing, transportation, wholesaling, and retailing of a well-defined food supply.

More specifically, 1890 institutions lack many of the physical facilities necessary to conduct much-needed basic research. Congress recently approved a measure to help the 1890 universities build and equip laboratories. During congressional hearings on this legislation, Dr. Anson R. Bertrand, director of the USDA's science and education unit, testified—and I quote:

"The research capability of these institutions is not comparable to that of the 1862 land-grant institutions. The 1890 institutions have received limited state construction funds for research facilities. Furthermore, they were not eligible to participate in the modest federal facilities program provided in the late 1960's and early 1970's for the 1862 land-grant institutions under the research facilities act of 1963 this act does require State-matching funds.

The absence of sufficient research facilities has forced the institutions to use the space provided for resident instruction and other campus programs to accommodate the research work supported by the payments to these institutions available under Public Law 95-113. In some institutions, scientists are conducting research in classrooms during the hours that those rooms are not used for student instruction.

As a result, these institutions have been forced into relatively limited agricultural research programs, which have been developed by "making do" under unfavorable circumstances. They have been unable either to develop research programs that could provide expertise to complement and enhance their instruction and extension program needs, or to participate with the 1862 land-grant institutions in a balanced attack on the agricultural research problems in their States."

In spite of those conditions so precisely described in Dr. Bertrand's statement, the 1890's have made heroic strides in addressing food and agriculture research problems faced by this Nation. They ought to be firmly supported.

As to this subcommittee's second question, concerning the role of land-grant colleges and universities in establishing measurable national research goals and the process necessary to meet these goals—I feel the land-grant universities can play a major role in shaping needed federal policies and goals.

The agriculture industry is composed of such diverse—and not always harmonious—groups, that meaningful policies must consider each of these components and balance their varied interest—and balance them in a manner consistent with national food needs. The members of the land-grant universities are uniquely qualified to ensure that each of these components and component interests is reconciled.

We in the land-grant system are also aware that the elements are so diverse and potentially divisive that strong leadership is required to compel various economic interests to direct their energies and expenditures in a manner consistent with domestic and international food needs in this century.

We the representatives of the land-grant system are circumscribed in our authority and our missions by the Congress. And we are all aware that among the fundamental issues facing agriculture is land-use, yet such fundamental and vital issues affecting our future capacity for food production must be addressed in broader arenas than agriculture. The same is true of most of the major impediments to our agricultural production, impediments such as tight money and high interest rates.

We are prepared to help develop the needed national policies and goals, but to be meaningful, we need the broadest possible mandate from Congress, and its fullest support. The capacity is there.

Mr. SCHEUER. Thank you, Dr. Williamson, for a very thoughtful and provocative statement.

Now we will hear from Dr. Wing.

Dr. WING. Thank you, Mr. Chairman.

I am pleased to have this opportunity to testify before this subcommittee. I am Kenneth Wing, dean of the College of Life Sciences and Agriculture and Director of the Maine Agricultural Experiment Station. I am testifving as chairman of the Experiment Station Committee on Organization and Policy, ESCOP.

ESCOP is the national policy group through which we in the State agricultural experiment stations can address important issues collectively, consider interactive improvements, and stimulate research actions to help agriculture.

I speak for over 13,000 scientists and their administrators in the 50 States and several territories who collectively conduct almost 60 percent of the publicly supported research serving agriculture throughout the Nation. These scientists are located where agriculture starts—at the production end. They are highly familiar with the almost half billion acres of cropland and a billion acres of pasture and rangeland across all of our States and territories and their ecological variations and the crops and livestock that depend on these resources.

By being close to agriculture, they are knowledgeable of it and they are sensitive to those who make their living from it. They and their predecessors have served agriculture well. Their past successes and the future promise of their research and the need for it has caused State legislatures, the funding institutions closest to the results of their work, to increase their investments in State agricultural experiment stations more in recent years than has the Federal Government.

THE AGRICULTURE WE SERVE

We interpret agriculture in the same broad sense as has the Congress in the Hatch Act. The changing characteristics and needs of agriculture, as best they can be predicted, will continue to be the primary influence on the research profile.

Production agriculture, along with forestry, will continue to be the primary direct user of solar energy. The pattern and location of natural endowments of land, water, topography, growing seasons, and temperature will continue to be the primary determiners of agricultural production profiles. Drought, flooding, unfavorable temperatures, pests, and damaging winds will add the certainty of uncertainty so long as agriculture depends on open fields.

The side effects of agriculture and other side effects affecting agriculture probably will grow in importance on the research agenda, particularly those side effects which influence directly long-range agricultural productivity—soil losses, water losses and contamination, and soil contamination.

As our productivity and production levels increase, more attention must be given to protecting the advances we have already made and to reduce physical, biological, and nutrient losses in production, marketing, processing, and storage of agricultural products.

Mr. SCHEUER. What page of your testimony are you on?

Dr. WING. Three.

My comments now will be addressed toward title XIV, which we look at as a charter for agricultural research, and I think that this may answer some of the questions that you have asked, particularly about the agricultural research planning process.

The research sections of title XIV of Public Law 97-98, the Agriculture and Food Act of 1981, have articulated the core issues very well and have identified which of these require strengthening through stronger support and modification. Title XIV also authorizes some new initiatives complementary to the base agricultural research programs. We subscribe to and support this updated mandate of the Congress now in law, for the following reasons:

(1) Agricultural productivity, efficiency, and longevity are specified as the primary goals of research and education.

(2) The essentiality of research to improve agriculture is recognized.

(3) The USDA-State partnership in research is documented to show the value of encouragement of State support for agricultural research, the contributions of the partnership research institutions to the "outstanding successes achieved in meeting the varied, dispersed and, in many cases, site-specific needs of American agriculture," and the Congress concluded by stating, "this partnership must be preserved and enhanced."

(4) For the first time in the history of the USDA, a position of Assistant Secretary specifically for Science and Education was authorized. We believe this will have a significant role in enhancing the planning process.

(5) The reemerging concern for the long-term viability of the production sectors of agriculture stimulated two more congressional pronouncements in the revised title XIV.

(a) Use "wherever possible, the existing regional research, extension, and teaching organizations of State cooperative institutions to provide regional planning and coordination."

(b) Assign to the Joint Council responsibility to improve "planning and coordination of publicly and privately supported food and agricultural science activities and by relating Federal budget development and program management to those processes."

We believe these changes represent another important example of the capabilities of Congressmen and Senators to fashion legislation that recognizes State-by-State characteristics while serving national purposes. We firmly believe that this newly fashioned and modified piece of legislation should be given a chance to work. We intend to do all we can to carry out its provisions and try to help accomplish its purposes as we look at some of the challenges ahead.

The challenges ahead for agriculture are complex. Research is essential to help agriculture progress within that dynamic complexity.

I would like to list a few important issues as we see them and to illustrate briefly how those issues are being addressed and what further might be done.

First, development of knowledge required for further applied progress. Approximately 37 percent of all research in the State agricultural experiment stations is classified as basic. The other classifications in the Current Research Information System, CRIS, are applied and developmental. Basic research in agriculture is motivated by the "need to know," a recognition that such knowledge is often prerequisite to applied progress.

These research inquiries often range as deeply into the unknown as research projects to extend scientific knowledge and understanding for its own sake. This has resulted in similar proportions of Nobel laureates and memberships in the National Academy of Sciences among agricultural scientists as compared with the large industrial research and development complexes, who also have to fulfill their "need to know" to identify new and novel advances that benefit their parent firms.

As an important dimension in basic research valuable to agriculture, we reaffirm our support of the competitive grants program.

Second, improved systems for agriculture. Systems of agriculture and those systems on which agriculture depends need more attention. Advances in obtaining, storing, and processing masses of data in various forms permit research responses to longstanding needs.

The Michigan experiment station has inaugurated a comprehensive analysis of the State's natural resource base, in active cooperation with units of State government responsible in that area and with Federal agencies active in remote sensing. Other State stations are developing new cropping and crop protection systems that are intended to be ecologically, environmentally, technologically, and economically feasible for the farmer and producer users.

A number of other less comprehensive systems are being developed and refined, such as conservation tillage systems that combine economic attractiveness to the farmer with conservation values.

Third, USDA-State partnership in research. Recent analyses have shown the value of a centralized-decentralized publicly sup-

ported agricultural research system in this country, and in Japan, over a centralized system. Such a system works best if each part retains sufficient freedom for decisions to best accomplish its purpose, yet includes interactions that produce synergistic values to agriculture.

We might keep in mind that planning and accountability of agricultural research in the U.S.S.R. has been much more comprehensive and directed from the top for many years than has been true in the United States. We might also keep in mind the relative productivity of U.S. and U.S.S.R. agriculture.

Fourth, sensitivity of the State stations to emerging problems and needs. There have been many examples of early recognition and response to emerging situations in agriculture and forces affecting agriculture well before such situations attract Federal attention and deserve serious Federal action.

Examples include a doubling of scientist-years in research on environmental quality at the State stations by 1972, largely through reallocation of resources. A regional research project on acid rain which started in 1977 under the Hatch program included 27 cooperating States and a number of collaborating Federal agencies by 1981. Supplementary Federal funding for the project began in 1982.

Fifth, adapting and moving improved technologies into developmental and acceptance stages. Many improved technologies are directly insertable into existing commerce or appear to be sufficiently promising of profit to business firms.

Some new technologies that require new marketing and processing streams, or which do not warrant much commercial attention during their small-scale formative period, will benefit from Federal developmental help beyond that which can be accomplished by agricultural research institutions alone.

One example is the potential for processing and marketing of leaf proteins for supplementation of rations for swine and poultry, which are very limited in their capacities to utilize leaf meal. Other examples include aquaculture, to which State stations are already devoting over 66 scientist-years of research, and rubber producing plants such as guayule.

Sixth, analysis and judgment of each level of agricultural research on its own achievement of purposes. Much has been made of an earlier statement that much of agricultural research is "pedestrian." On the one hand, we recognize the increasing and essential contributions from sophisticated science. On the other hand, we note the positive correlation between numbers of branch experiment stations in individual States and their rates of improvement in agricultural productivity.

We contend that agricultural improvements will depend on vitality and effectiveness all along the continuum of research and development, and that user acceptance at the farmer level is as essential as superior science at the other end of the process of agricultural innovation. We caution against measuring agricultural research only on the basis of scientific amazement, particularly if agricultural significance is disregarded or downgraded thereby.

We have stressed primarily in our statement the State agricultural experiment stations. We also recognize the important and unique contributions of the USDA in-house research agencies, the

growing significance of cooperating forestry schools, and the needs for Federal support of food animal health research in the veterinary colleges as well as in the experiment stations. We also welcome and support the growing research performance of the sixteen 1890 Land Grant colleges and Tuskegee Institute. Dr. Handy Williamson has described to you their role and prospects for the future.

We maintain close liaison and functional relationships with all of these groups of research institutions and with comparable groups in agricultural industries. We benefit from the indispensable role of cooperative extension services who interpret and disseminate the outcomes of research to users and provide us feedback that is required to keep our research practical and useful at the applied end.

We all serve American agriculture, though in different ways. We all want State and Federal tax dollars to be used wisely and well. They come from the same taxpayers.

In conclusion, we firmly believe that the State agricultural experiment stations, cooperating forestry schools, 1890 colleges, Tuskegee Institute, and veterinary colleges can and will contribute a great deal to solving long-term as well as shorter term agricultural productivity problems through research and that we can and should be part of the process of developing useful research goals for agriculture.

We are and will continue to be dedicated to carry out whatever goals and purposes will best serve agriculture in the years ahead. Since we all serve one American agriculture, we believe that establishment of goals and strategies to implement those goals should be a partnership effort as articulated in title XIV, and that the major performers of research, public and private, should be party to their establishment with due regard to the resources and circumstances of each group.

Much of the research planning and implementation will be done within research organizations, but there should be awareness of similar research by others, and collaboration and coordination that results in synergistic values to agriculture should be identified and captured.

We welcome suggestions and assistance from your subcommittee that will help us work more effectively. Thank you.

[The prepared statement of Dr. Wing follows:]

PREPARED STATEMENT OF DR. KENNETH E. WING, CHAIRMAN, EXPERIMENT STATION COMMITTEE ON ORGANIZATION AND POLICY, AND DEAN, COLLEGE OF LIFE SCIENCES AND AGRICULTURE, UNIVERSITY OF MAINE, AND DIRECTOR, MAINE AGRICULTURAL EXPERIMENT STATION

INTRODUCTION

I am pleased to have this opportunity to testify before this Subcommittee. I am Kenneth Wing, Dean of the College of Life Sciences and Agriculture and Director of the Maine Agricultural Experiment Station. I am testifying as Chairman of the Experiment Station Committee on Organization and Policy (ESCOP).

ESCOP is the national policy group through which we in the State agricultural experiment stations can address important issues collectively, consider interactive improvements, and stimulate research actions to help agriculture.

We appreciate the interest of your subcommittee in the agriculture we have been serving through research for over a century, and we want to be as helpful to you in your deliberations as we can.

I speak for over 13,000 scientists and their administrators in the 50 states and several territories who collectively conduct almost 60 per cent of the publicly supported research serving agriculture throughout the nation. These scientists are located where agriculture starts—at the production end. They are highly familiar with the almost half billion acres of cropland and a billion acres of pasture and rangeland across all of our states and territories and their ecological variations and the crops and livestock that depend on these resources.

By being close to agriculture, they are knowledgeable of it and they are sensitive to those who make their living from it. They and their predecessors have served agriculture well. Their past successes and the future promise of their research and the need for it has caused State legislatures, the funding institutions closest to the results of their work, to increase their investments in State agricultural experiment stations more in recent years than has the federal government.

THE AGRICULTURE WE SERVE

We interpret agriculture in the same broad sense as has the Congress in the Hatch Act. The changing characteristics and needs of agriculture, as best they can be predicted, will continue to be the primary influence on the research profile.

Production agriculture, along with forestry, will continue to be the primary direct user of solar energy. The pattern and location of natural endowments of land, water, topography, growing seasons and temperatures will continue to be the primary determiners of agricultural production profiles. Drought, flooding, unfavorable temperatures, pests, and damaging winds will add the certainty of uncertainty so long as agriculture depends on open fields.

Economic forces will influence the balance and intensity of commodities grown in the various areas. The intensity of the cost-price squeeze will continue to have major effects on the balance between short-term needs and longer-term considerations by individual farmers and producers

The agricultural products bought 20 years from now and their amounts and proportions are as important in determining today's research agenda as what can be produced most efficiently.

The side effects of agriculture and other side effects affecting agriculture probably will grow in importance on the research agenda, particularly those side effects which influence directly long-range agricultural productivity—soil losses, water losses and contamination and soil contamination.

As our productivity and production levels increase, more attention must be given to protecting the advances we have already made and to reduce physical, biological, and nutrient losses in production, marketing, processing, and storage of agricultural products.

TITLE XIV—A CHARTER FOR AGRICULTURAL RESEARCH

The research sections of Title XIV of Public Law 97-98, the Agriculture and Food Act of 1981, have articulated the core issues very well and have identified which of these require strengthening through stronger support and modification. Title XIV also authorizes some new initiatives complementary to the base agricultural research programs. We subscribe to and support this updated mandate of the Congress now in law, for the following reasons:

1. Agricultural productivity, efficiency, and longevity are specified as the primary goals of research and education.

2. The essentiality of research to improve agriculture is recognized through past performance and through our greater dependence on research for meeting the "dynamic and constantly changing" needs of agriculture for the future.

3. The USDA-State partnership in research is documented to show the value of encouragement of state support for agricultural research, the contributions of the partnership research institutions to the "outstanding successes achieved in meeting the varied, dispersed and, in many cases, site-specific needs of American agriculture", and the Congress concluded by stating, "this partnership must be preserved and enhanced".

4. For the first time in the history of the USDA, a position of Assistant Secretary specifically for Science and Education was authorized.

For the first time, the Secretary of the Department of Agriculture will have in the front row of his policy advisors a person selected for capabilities for federal leadership in agricultural research and education. No longer will this important leadership role be an add-on to other important responsibilities or relegated to the second rank of the Secretary's Advisory circle.

5. The re-emerging concern for the long-term viability of the production sectors of agriculture stimulated two more Congressional pronouncements in the revised Title XIV.

(a) Use "wherever possible, the existing regional research, extension, and teaching organizations of State cooperative institutions to provide regional planning and coordination".

(b) Assign to the Joint Council responsibilty to improve "planning and coordination of publicy and privately supported food and agricultural science activities and by relating Federal budget development and program managment to those processes".

These provisions, particularly important to research on production agriculture and the numerous and variable endowment areas used for agricultural production, recognize that government processes should be reasonably adapted to the characteristics of agriculture itself and the State and USDA components of the publicly supported research system. These provisions also recognize that budget development should reinforce research program improvement, including its joint planning and coordination dimensions, as well as influence changes in emphasis and direction. Support for agricultural research is an economically sound investment in agricultural improvement which must be proportionalized, prioritized, and implemented at local, state, multi-state, and national levels based on the most knowledgeable expertise at each of those levels. It recognizes that 34 states each produce over $1 billion in cash farm receipts annually and that two other states rank among the top seven states in cash farm receipts per unit of state area. It also recognizes that the components of those farm sales and the circumstances of their production vary widely among those states.

We believe these changes represent another important example of the capabilities of Congressmen and Senators to fashion legislation that recognizes state-by-state characteristics while serving national purposes. We firmly believe that this newly fashioned and modified piece of legislation should be given a chance to work. We intend to do all we can to carry out its provisions and try to help accomplish its purposes.

THE CHALLENGES AHEAD

The challenges ahead for agriculture are complex. Research is essential to help agriculture progress within that dynamic complexity. Some of the more unique and important discoveries important to agricultural progress may be imagined by us, but will be activated only by scientists who are assembled and encouraged to combine scientific capabilities with understandings of fundamental phenomena in agriculture. It is the inventive complexity that caused a Bell Laboratory official to remark that "we manage for research; we don't manage research".

I would like to list a few important issus as we see them and to illustrate briefly how those issues are being addressed and what further might be done.

1. *Development of knowledge required for further applied progress.*—Approximately 37 percent of all the research in the State agricultural experiment stations is classified as basic. The other classifications in the Current Research Information System (CRIS) are applied and developmental. Basic research in agriculture is motivated by the "need to know", a recognition that such knowledge is often prerequisite to applied progress.

These research inquiries often range as deeply into the unknown as research projects to extend scientific knowledge and understanding for its own sake. This has resulted in similar proportions of Nobel laureates and memberships in the National Academy of Sciences among agricultural scientists as compared with the large industrial research and development complexes, who also have to fulfill their "need to know" to identify new and novel advances that benefit their parent firms.

This "need to know" has caused agricultural reseach administrators to hire mostly scientists who are trained in basic sciences, including those in applied departments. For example, in the Department of Agronomy at the Wisconsin station, basic research training and self-improvement activities have enabled an alfalfa breeder-geneticist to improve breeding methodology for alfalfa over a 20 year period. This has included combining of genetic engineering techniques with tissue culture and plant regeneration improvements over the past eight years. Another member of the same department, who has been collaborating with a NAS member biochemist as well as his agronomic associates, recently headed the competitive grants program in the USDA for a year to the satisfaction of the scientific community and the USDA. The increase in hiring of young scientists well trained in one or more disciplines allows many of the basic inquiries to be carried out by the same scientists

who seek applied usefulness, permits them to identify and capture leads with potential for applied usefulness, and results in more effective collaboration and corporation with basic scientists on the frontiers of disciplinary knowledge. These interactions with scientists in basic research also attracts the attention and involvement of such scientists to problems and opportunities that combine scientific promise and potential agricultural usefulness.

The capabilities of scientists at State stations engaged in applied as well as basic research is enhanced by the availability of advanced research equipment and proximity to a wise range of scientific expertise made possible by almost all agricultural experiment stations being located within well-developed land-grant universities.

As an important dimension is basic research valuable to agriculture, we reaffirm our support of the competitive grants program. We supported the program at its inception, and we support it now. Our only hesitation was at the time of its inclusion for the second time in a Presidential budget. That budget proposed a further $15 million increase (over a $15 million base, and, in the same sentence, a decrease of $9.4 million in Hatch appropriations. We continue to favor further increases in funds under this program as an important complement to base funding. We oppose substitution of competitive grants for base funding support.

We urge the Congress to seek incentive systems that will bring the scientists in agricultural research and those in similar disciplinary fields closer together in mutually acceptable ways. Even in research on single-celled organisms, transfer of advances from a non-agricultural life form to one that has potential for agriculture is more apt to take place through various means of personal collaboration than through public exposure of results alone. This is especially true if there is already considerable knowledge of the comparable agricultural organism and the agricultural milieu in which it must function.

Such incentive systems should also recognize that consensus judgments of knowledgeable groups can identify areas of both scientific and agricultural promise, but identification of specific advances will continue to depend on individual entrepreneurship.

2. *Improved systems for agriculture.*—Systems of agriculture and those systems on which agriculture depends need more attention. Advances in obtaining, storing, and processing masses of data in various forms permit research responses to longstanding needs.

The Michigan experiment station has inaugurated a comprehensive analysis of the state's natural resource base, in active cooperation with units of state government responsible in that area and with federal agencies active in remote sensing. Other state stations are developing new cropping and crop protection systems that are intended to be ecologically, environmentally, technologically and economically feasible for the farmer and producer users. A number of other less comprehensive systems are being developed and refined, such as conservation tillage systems that combine economic attractiveness to the farmer with conservation values.

Federal incentives that will help those processes will speed up realization of their long-range benefits.

3. *USDA-State partnership in research.*—Recent analyses have shown the value of a centralized-decentralized publicly supported agricultural research system in this country, and in Japan, over a centralized system. Such a system works best if each part retains sufficient freedom for decisions to best accomplish its purpose, yet includes interactions that produce synergistic values to agriculture.

We might keep in mind that planning and accountability of agricultural research in the USSR has been much more comprehensive and directed from the top for many years than has been true in the U.S. We might also keep in mind the relative productivity of U.S. and USSR agriculture.

4. *Sensitivity of the State stations to emerging problems and needs.*—There have been many examples of early recognition and response to emerging situations in agriculture and forces affecting agriculture well before such situations attract federal action and deserve serious federal attention.

Examples include a doubling of scientist-years in research on environmental quality at the State stations by 1972, largely through reallocation of resources. A regional research project on acid rain which started in 1977 under the Hatch program included 27 cooperating states and a number of collaborating federal agencies by 1981. Supplementary federal funding for the project began in 1982.

5. *Adapting and moving improved technologies into developmental and acceptance stages.*—Many improved technologies are directly insertable into existing commerce or appear to be sufficiently promising of profit to business firms.

Some new technologies that require new marketing and processing streams, or which do not warrant much commercial attention during their small-scale formative

period, will benefit from federal developmental help beyond that which can be accomplished by agricultural research institutions alone.

One example is the potential for processing and marketing of leaf proteins for supplementation of rations for swine and poultry, which are very limited in their capacities to utilize leaf meal. Other examples include aquaculture, to which State stations are already devoting over 66 scientist-years of research, and rubber producing plants such as guayule.

Some specialized and potentially useful authorizing legislation has already been written into law. Appropriations have been limited or not provided.

6. *Analysis and judgment of each level of agricultural research on its own achievement of purposes.*—Much has been made of an earlier statement that much of agricultural research is "pedestrian". On the one hand, we recognize the increasing and essential contributions from sophisticated science. On the other hand, we note the positive correlation between numbers of branch experiment stations in individual states and their rates of improvement in agricultural productivity.

We contend that agricultural improvements will depend on vitality and effectiveness all along the continuum of research and development, and that user acceptance at the farmer level is as essential as superior science at the other end of the process of agricultural innovation. We caution against measuring agricultural research only on the basis of scientific amazement, particularly if agricultural significance is disregarded or downgraded thereby.

The Hatch Act recognizes the broad aspects of agriculture. Through this Act, the Congress states, "It shall be the object and duty of the State agricultural experiment stations . . . to conduct original and other researches . . . including researches basic to the problems of agriculture in its broadest aspects, and such investigations as have for their purpose the development and improvement of the rural home and rural life and the maximum contribution by agriculture to the welfare of the consumer . . .". The aggregate result of individual research initiatives functionally coincide with that mandate of the Congress even though the majority of the research funds come from State sources. Over a third of the research at the State stations is dedicated to improve natural resource conservation and use including effects of agriculture on environmental quality, human nutrition and food safety, rural development and improvement of marketing processes.

We have stressed primarily in our statement the State agricultural experiment stations. We also recognize the important and unique contributions of the USDA inhouse research agencies, the growing significance of cooperating forestry schools, and the needs for federal support of food animal health research in the veterinary colleges as well as in the experiment stations. We also welcome and support the growing research performance of the sixteen 1890 Land-Grant colleges and Tuskegee Institute. Dr. Handy Williamson will describe to you their role and prospects for the future.

We maintain close liaison and functional relationships with all of those groups of research institutions and with comparable groups in agricultural industries. We benefit from the indispensable role of cooperative extension services who interpret and disseminate the outcomes of research to users and provide us feedback that is required to keep our research practical and useful at the applied end.

We all serve American agriculture, though in different ways. We all want State and Federal tax dollars to be used wisely and well. They come from the same taxpayers.

In conclusion, we firmly believe that the State agricultural experiment stations, cooperating forestry schools, 1890 colleges and Tuskegee Institute and veterinary colleges can and will contribute a great deal to solving long-term as well as shorter term agricultural productivity problems through research and that we can and should be part of the process of developing useful research goals for agriculture. We are and will continue to be dedicated to carry out whatever goals and purposes will best serve agriculture in the years ahead. Since we all serve one American agriculture, we believe that establishment of goals and strategies to implement those goals should be a partnership effort as articulated in Title XIV, and that the major performers of research, public and private, should be party to their establishment with due regard to the resources and circumstances of each group. Much of the research planning and implementation will be done within research organizations, but there should be awareness of similar research by others, and collaboration and coordination that results in synergistic values to agriculture should be identified and captured.

We welcome suggestions and assistance from your subcommittee that will help us work more effectively.

Mr. SCHEUER. Well, thank you and thanks to the panel for your three extraordinarily interesting and thought-provoking presentations of testimony. I now yield to the full chairman of the Science and Technology Committee, Congressman Don Fuqua of Florida.

Mr. FUQUA. Thank you, Mr. Chairman, and let me also add my congratulations to the panel for very excellent statements.

Dr. Kidd, particularly to you, but other panelists may want to address it, you mentioned in your statement the increase in the price of energy as it affects agriculture, and also the shortage of fresh water which I think are two very, very important issues. I am wondering if you see that there is a national policy at this time of trying to do something about both of those issues and what role could our agricultural colleagues have in trying to address those two problems.

Dr. KIDD. I think that I don't discern any clear-cut national policy that is comprehensive enough to cover both areas. I do think that there is a high level of concern. There are national objectives with respect to helping out in both situations but I think with respect to the appropriate technology and conservation, the emphasis seems to be on what Americans seem to be most concerned about and that is mobility, vehicular mobility, which we hear more about than we do concerns in the area of food production and applied appropriate technology for conservation.

Mr. FUQUA. Isn't that true by virtue of the fact that American agriculture has been very successful, that a high productivity rate exists and people generally take it for granted? So if we get into a struggle between whether energy is going for food production or whether it is going to heat your house or operate your automobile, then that is in my opinion a very difficult conflict to be put into.

I am afraid agriculture may lose.

Dr. KIDD. I think so without some emphasis at this point by people who are involved in agriculture research and, of course, by people involved in Government who can see ahead.

I think our institutions, all the land-grant institutions, particularly 1890 institutions, have a particular role to play, especially with respect to conservation and appropriate technology as these affect small farmers.

Appropriate technology is a geographical phenomenon. I guess you have heard already that agriculture is always going to be—productivity will always be—contingent on the local conditions, climate, geological conditions, what grows and what doesn't grow in a certain area.

Applied appropriate technology is the same kind of consideration. There are things that will work in terms of small farm operations in Florida that will not work in Arizona and vice versa.

But I think that if the proper incentives could be given to agencies like our own, research capabilities would be developed to concentrate on encouraging farmers to seek solutions by the application of appropriate technology. To find incentives for small farmers to use alternative fuels in their operations, you could use a model that we might discover in our own demonstration farm, for example.

We take demonstrations to farms, but we also would like to conduct ongoing systematic research and demonstration on our own

research farm—wherein we could test and measure the effectiveness of certain applied appropriate technological measures.

I think, of course, as has already been stated, all this requires a greater influx of dollars to do agricultural research than we presently enjoy.

Mr. FUQUA. Is USDA directing any efforts in these areas, particularly in energy and water conservation?

Dr. KIDD. In the conferences I have attended around the country on a regional basis, there has been quite a bit of emphasis placed on research in terms of energy, environmental factors, and applied appropriate technology; but again we are talking about looking at a spectrum of research projects—projects that you don't start today and cut off next year.

The crunch always comes when you want to do something new. You have got ongoing research that is valid, that is viable, and you need to add to it. Usually the dollars just aren't there.

Mr. FUQUA. Dr. Wing, do you think USDA is doing enough in those areas?

Dr. WING. Specifically on the use of energy?

Mr. FUQUA. And also the conservation of water. I am not just speaking of terracing or soil conservation methods that we are accustomed to which are fine, but also methods to try to contain moisture content within the soil, for instance.

Dr. WING. The USDA is certainly very active in this area.

I would speak from a more specific location, the stateside location, specifically in this case the State of Maine. We are concerned with the loss of soil because of open land that is continually in potatoes. One of the concerns that we have is whether or not the farmers can afford to put the conservation measures into effect that we already know about because of past research.

We are now involved in a joint research project that will give us answers to the economic questions. Does it pay to install conservation practices in terms of the quality and quantity and long range usability of that land? At the local level we are certainly very actively involved in that in conjunction with the USDA agencies. It is of prime concern.

If we can tie in with that some considerations of minimum tillage to reduce erosion and reduce the energy costs, we will have moved a step forward.

I think there is a very active program in both those areas.

Mr. FUQUA. Is it active enough?

Dr. WING. I think it is, yes. It could be more active if we had additional resources.

Mr. FUQUA. Could more money be utilized efficiently?

Dr. WING. I think very definitely. I think there is another example in the energy problem, one we face in Maine.

Maine has a large peat resource. There is currently a great debate as to what is the best use of that resource. An alternative is to remove it for heating homes in the winter. As oil prices approximate $1.25 a gallon, we thought seriously about that. The highest value is to mine that peat and export it to Massachusetts to use in home gardens.

The best idea may be to leave it in place as a natural resource area.

11-864 O - 83 - 13

The debate about a natural nonrenewable resource in the short run continues. We don't have the answers yet, but we are doing research on that area.

Mr. FUQUA. Dr. Williamson, do you have any comments to add or subtract?

Dr. WILLIAMSON. I would like to make one brief comment in terms of your question regarding what the UDA is doing.

I am aware of a task force in the southern region, some 4 years ago, when energy was looked upon as being important; that is, dollars were spent—about to be spent—to address energy problems.

There was a task force to look at that energy use and conservation in agriculture. I served on that task force. Several Southern experiment station directors and other people were represented. There was an impressive study done. Somehow along the way the amount of emphasis on energy—in terms of dollars provided for energy research and because of the signals from other agencies to pull back from solar research—somehow the emphasis has decreased.

I think perhaps there is a lot known in terms of the problems and different research approaches that must be taken, but I think in order to address those problems in a continuous way—not in a stop/start fashion depending upon someone's whim—there must be continuous resources given to the researchers in the land-grant institutions.

Mr. FUQUA. Thank you, Mr. Chairman.

Mr. SCHEUER. Thank you. This was an extremely interesting panel.

Dr. Wing, I think you summed up a consensus on the panel when you said on page 12 of your testimony at the bottom,

> Since we all serve one American agriculture, we believe that establishment of goals and strategies to implement those goals should be a partnership effort as articulated in title 14 and that the major performers of research, public and private, should be a party to their establishment with due regard to the resources and circumstances of each group.

That is a very clear statement of what the goals should be; we need a pluralistic agricultural research establishment with each of the players playing a proper role, but we need direction in pulling it all together—establishing that partnership effort the role of the major performers.

You heard the testimony of the Assistant Secretary of the Department. You heard me describe just very briefly the seeming consensus in these three critical evaluations—by OTA, by CRS, and by the GAO—that a great deal more could be done in formulating national goals, in establishing priorities, and then in setting the roles for each of the elements in this pluralistic system.

Do you think that that is being done? Do you think the Department of Agriculture has taken whatever lessons are to be taken from those three reports and updated its capability to establish long-term research goals and priorities and to do some role-setting among the various elements, or do you think there is more that they could be doing?

Dr. WING. Two answers.

Yes, they are doing it.

Yes, they, as all agencies, could do more.

I think title XIV establishes an open door for doing a tremendous amount of things in this area, both from the USDA standpoint in the in-house research activity and with the State experiment stations.

The Joint Council has been created to do exactly the kind of advance planning that should be in place in addition to that which is already occurring.

The National Program Staff in the Agricultural Research Service plans constantly for current and future needs. The experiment station system has State, local and national planning activities that are concerned with what we are doing. Is it right, what should we be doing, and how do we gear up to do that? Do we have the technology in place that can answer questions for 20 years down the line?

I think we have a very active planning and coordinating process and I think the success of American agriculture is a demonstrated item of performance of the system as it now exists.

We have been successful. We are not faced by overall starvation and shortfalls.

Major problems concern, in my opinion, the use of the food, not the productivity of American agriculture.

Part of that policy has to answer for whom should that food be produced domestically and in foreign markets, and by what process should it be distributed?

I think there is a good planning process already in place. I think the scientists are firstrate. I think performance is something that perhaps is underrated in those three and many other reports. Performance speaks for itself. We are going to continue to perform.

Mr. SCHEUER. Very good.

Dr. Kidd, would you like to respond to that?

Dr. KIDD. The only thing I would like to say by way of response to that is just an add-on comment, that planning, of course, is a dynamic process.

I would hope that planning efforts carried out or to be carried out by USDA officials and others in the very near future will address more specifically some of the concerns that have been raised in the reports that you have cited.

I don't think any of the researchers, any of the administrators involved, are entirely ignorant of the problems cited or have not heard those criticisms before.

I think in the new wave of planning that will take place during this fiscal year, I am sure those things will be addressed.

From our point of view the 1890 institutions—administrators, researchers, faculty members—all stand ready to participate in that planning process.

Mr. SCHEUER. Dr. Wing, in his statement, said the process of identifying goals should be a partnership effort as articulated in title XIV.

Have you been involved in that process?

Dr. KIDD. We have.

Mr. SCHEUER. You are satisfied to the degree you have been involved?

Dr. KIDD. We would like to be more involved. We would like to be continually involved.

Mr. SCHEUER. Dr. Williamson?

Dr. WILLIAMSON. I would like to concur with Dr. Kidd's last comment to say we have, and since I have been involved with the association of 1890 research directors over the past 6 years, our involvement has increased almost in a correlative fashion with the amount of support that comes from the Central Government.

As an example, the facilities bill that has been supported by the administration, has, I think, directed increased involvement. Where it will go, I am not really sure.

We serve on a number of committees, a number of task forces, and a number of boards, but one must keep in mind that the original motivation for this involvement has been representational.

I don't know whether there has been an expectation that there will be significant input, but I think the people who serve on committees and boards and who assist with the business of conducting the land grant system will be making a viable input.

I think we will take a strong look at continuous involvement of 1890 representation in the policymaking arena, in the goal-setting arena.

My colleague to my left, Dr. Ken Wing, and my other friends in ESCOP have made us feel quite welcome.

I don't want to slight their efforts in the attempt to pull us into the system.

Thank you.

Mr. SCHEUER. Dr. Kidd, on page 4 of your testimony you indicate that the main objective of agricultural research at the 1890 institutions is to help low-income, limited-resource farmers and small-acreage operators.

You mention that research is needed in the area of nutrition, improvement of crop plans, reclamation of wastelands, and prevention of pollution.

Should these research needs that you have elaborated be high priority national goals?

Dr. KIDD. I think they are worthy of being high priority national goals. I think our national goals in general with respect to agriculture ought to be articulated to the point of the general public understanding what our national goals are.

I think that is one of the problems that we run into all the time when we go and speak to an audience of small farmers in a rural community; they have already assumed that no one is interested in their particular problem: That it is not only not a national goal, but not a goal, period.

So I think these problems ought to be national goals, ought to be high priority, ought to be mentioned, and ought to be communicated generally in public.

Mr. SCHEUER. What kind of mechanism do you think would be necessary for these kinds of research needs to be met?

Dr. KIDD. Well, we have a system now——

Mr. SCHEUER. Is the existing system or the existing establishment adequate to identify these as national goals and to permit these goals to be fulfilled or do you think some changes should be made in the system?

Dr. KIDD. I think some changes are necessary.

Again, they are economic. I think, No. 1, besides communicating what our national goals are, especially as they address the needs of small farmers, that has to be done from the Federal level, from the top down, and as we, the actors in this research process, get the message and can communicate this message to the clientele that we attempt to serve, I think there ought to be incentives for research organizations or for institutions involved in research to put these things higher up on their list of priorities as they seek to expand or revamp their research programs.

Moreover, when we look at it, it has to be an expansion, because all the projects that we already have are good projects and ones to which the answers are needed.

So what I am saying again is that we need additional resources, and with respect to the question I think that in order to see to it that the needs of small farmers are high priority and are addressed, that perhaps incentives ought to be given to research organizations and institutions to, as they think about expansion, give higher expansion to these and there ought to be dollars provided for that specific purpose.

Mr. SCHEUER. As you have both laid out, the mission of the 1890 institutions—to help low-income, limited-resource farmers, and small acreage operators—isn't this pretty much the group that we are trying to help internationally—the small scale farmers in the developing countries—to do a better job of meeting the problems of drought, the problems of flooding, the problems of desertification, the problems of loss of top soil?

Dr. KIDD. That is very true.

Mr. SCHEUER. Is not much of this research relevant to their needs too? Isn't there a significant role that these 1890 institutions could be playing, not only in addressing the problems of small-acreage farmers here, but small-scale, small-acreage farmers in Asia, Africa, Latin America?

Dr. KIDD. I think that the problems are definitely similar. The research findings are definitely applicable. I think that the 1890 institutions are wellsprings of scientists and others who are capable of being ambassadors in this regard and taking the findings abroad and to serve in the appropriate advisory—technical advisory capacity to see to it that developing nations take advantage of what we have done and have been doing for some time.

I think also that we can serve in this regard in another way; that is, many of the developing countries have difficulty in getting the kind of education for their young people that would relate to their own food production and agriculturally related problems.

We have had some success in bringing these students to our own institutions for graduate level training, for undergraduate level training, but the resources to do this are very limited.

We, of course, are in an arena with much larger institutions that are also very attractive to people who are seeking education from developing countries. We think, however, that the brand of education that we offer with its emphasis on applied research, with this emphasis on the problems of small farms such as they find at home, would be most desirable for the people who are coming here, and we find that officials from those governments share those views, but resources, again, are very limited.

There are some assisting agencies such as the Southeast Consortium for International Development of which both of our institutions are members.

They are very helpful, but we need greater advocacy. We need perhaps to have a somewhat larger investment in that kind of effort.

One of the things we find is how receptive developing countries are to having small institutions such as the 1890 institutions come abroad in technical advisory capacity. They just generally do not know very much about the smaller institutions. That is where other organizations come in.

They can inform those host countries as to what we have to offer and be advocates for us.

We find also some of our own administrative policies are problematic in this regard. I guess this is a phenomenon shared with larger institutions. Faculties seek tenure, promotion, continuity. When you say go abroad to be of service, there is some question as to whether or not this is going to be credible service, in line with promotion and other job attributes. So we have some problems to solve in that regard.

Mr. SCHEUER. I can see that problem. I can see how an academic person who is upwardly mobile, like yourself or Dr. Williamson, might hesitate to go abroad for several years.

Might there not be a way—rather than giving people like you the mission of training farmers—we might give you the mission of training the trainers.

Dr. KIDD. Yes.

Mr. SCHEUER. Training the trainers of the trainers, so to speak. You can go abroad, perhaps, and develop a program with some top level people who would then take on the problem or the mission of training the trainers—who would be, in effect the agricultural extension or county agents, something like that, like those who have done such marvelous work with farmers, going back 100 years.

Dr. KIDD. I think that would be very appropriate.

Mr. SCHEUER. Isn't that a role many of the 1890 institutions could be handed?

Dr. KIDD. Could effectively be handed.

Mr. SCHEUER. The mission of training the trainers of the trainers?

Dr. KIDD. Exactly. We have to legitimize something that addresses a truly legitimate need. It is a shame we have to back into it that way, but what you describe, I think, is a very legitimate area of graduate study and training that institutions like Florida A. & M. University could well offer.

Mr. SCHEUER. With some inputs as to the particular psychological or sociological or cultural problems that you might run into in training farmers in the various regions of the world—setting up training programs that would address some of those cultural and psychological problems?

Dr. KIDD. I think that would be very appropriate. Many of our faculties have representation on them from Africa, from the Caribbean, and from elsewhere in the world. We have, I think, a ready resource to launch such a program.

Mr. SCHEUER. I notice, Dr. Williamson, on the next to the last line on page 5 of your testimony where you talk about the needs of consumers, that you state they are entitled to fresh foods, rich and tasty nutrition, grown nearby under conditions that insure maximum local employment.

I can understand in the developing world that the emphasis on employment is very important; the developing world, between now and the year 2000, will have a deficit according to the U.N. and the World Bank of about 800 million jobs. They need 800 million jobs created over the next 18–20 years.

That is more than the entire employed population of the developed world; so the need to create employment and livelihood is absolutely supreme in the developing world and, therefore, dictates the kind of technology that we should be giving them.

We shouldn't be giving them vast combines; we shouldn't have an obsession with high technology when what they urgently need is not only food production, but jobs production; and, what they need is appropriate technology to help them produce more efficiently—but not through widespread substitution of people by machines.

In the United States, we have a different problem, it seems to me. That is, to make small scale, small acreage farmers more productive by limiting the amount of manpower to which the small farmer has to pay wages and by enabling him to bring his crops to market at a cost to him which would be competitive with large-scale producers.

Also, it seems to me we have in this country a growing use of cheap, long-range transportation to bring crops to markets that are not nearby. We are all used to eating citrus fruits all year round. Those are brought quickly from where they are grown—I guess in Florida, Texas, and California—to urban populations in the North.

North Africa, Morocco, Israel, Lebanon, Syria—the whole strip of countries in North Africa—have developed over the last decade an enormous industry in exporting their crops by air to the northernmost reaches of Europe.

If you go to Finland, or Norway, or Denmark, you will be eating fresh vegetables or fresh tomatoes, fresh melons that were actually growing on the fields not 24 or 48 hours before.

So I wonder whether this emphasis on food grown nearby doesn't ignore the tremendous potential for small-scale farmers, small-acreage farmers in growing their crop for transportation by air and in refrigerated aircraft?

I wonder whether you are addressing the need where you talk about conditions that insure maximum local employment. Don't you perhaps underestimate the need for these small-acreage, small-scale farmers to be more competitive through more efficiency—and that may mean through some high technology, that they are better capable of understanding and using intelligently perhaps than small-scale, small-acreage farmers in the developing world who haven't been as well educated and who don't have the nearby resources provided by the 1890 institutions?

I don't want to make a long speech on this, but aren't you sort of limiting the degree to which we can help small-scale, small-acreage farmers in this country take advantage of not only immediate technology, but perhaps high technology if we can develop it on a scale

that they can afford and use intelligently—technology that might enable them to have the benefit of moving their crops to whatever market through whatever possibilities of cheap, swift transportation is available?

Dr. WILLIAMSON. Would you like a response to that, sir?

Mr. SCHEUER. Yes, because you raised those questions.

Dr. WILLIAMSON. I developed the point of view only briefly to the extent it could be addressed in the statement; but obviously, having grown up on a small farm in Mississippi, and having experienced or seen the problems and adjustments small farmer have and make over time—learning about small farmers, economic problems throughout my graduate study and being involved with the small farm research in less developed countries in Southern Africa, East Africa, and the Caribbean—I have a bias.

I think perhaps what I am trying to say is that we need to take a look at the possibility of giving some credits and support to having localized markets so that if small farmers are encouraged to produce vis-a-vis the research that we conduct, they have something to do with what they produce.

That produce ought not to be looked at as a nuisance by a large food chain that says your potatoes are not consistent in size and your beans are a little wilted, so we would rather get it from California or some other place where we can be assured of a strong supply network.

I think that we have suffered in this country from the lack of a policy to address the needs of the smaller farmers. I think if we are going to be consistent in our conducting research, we need policy that undergirds the provisions of the market, that allows them to dispose of their produce to do something at the end of the production season; we need policy to continue to support the research so as we divert our energy in that direction, we can be sure that what we do is worthwhile; that we are not doing it just for the sake of keeping our scientists employed on an area that is important temporarily in the policy arena.

I do want to make another comment with respect to 1890's and small-farm research. For some time now I have read documents and listened to testimony that alines 1890's with poor people and small farmers only. Obviously we cannot escape that alinement. We have been associated with it for some time. We came from that environment; but 1890 schools do more than just small-farm and rural-poverty research.

I think that ought to be recognized. I don't believe 1890's would accept a mission that says you take the poverty research when at some appropriate time poverty may not be considered important so what you are doing is then not considered important.

Everybody can recall the contributions of George Washington Carver's illustrious career of Tuskegee Institute. I think we have to recognize George Washington Carver was from an 1890. We have people following in his footsteps conducting significant basic research. We ought to be alined with more than rural poverty and small farms—we do make contributions in the basic research arena.

I thank you.

Mr. SCHEUER. Let me say this panel has been extraordinarily interesting to me. It has been a revelation and an education to me. I am just a street kid from Brooklyn and Queens and my knowledge in this whole area is skin deep. My curiosity is very deep and very wide. You have just opened up tremendous targets of opportunity for us in Congress and for our colleagues in the Department of Agriculture for making more use of the resources that you represent and it has been a spectacularly interesting morning for me.

You have really enriched my understanding. I want to express my gratitude to the three of you for your tremendously interesting testimony.

We still have another panel to hear from, so we are going to finish with this panel—but I am going to ask unanimous consent for us to address further questions to you in writing. I am absolutely delighted that the Department of Agriculture officials—who also gave us such excellent testimony here this morning—were able informally to spend a little bit of additional time so that they also have had the same privilege as I of hearing you directly.

I am delighted that they could spend the time to listen to you. That is part of the informal process by which this fertilization of ideas takes place.

Thank you very much for your fine testimony. You will be receiving some additional questions from us soon.

Mr. SCHEUER. We will now get to the second panel, composed of Dr. Michael Phillips, project Director, Food and Renewable Resource program of the OTA, and Mr. William Gahr, Associate Director for Community and Economic Development of the General Accounting Office.

Can I ask the two of you to introduce your associates for the record?

Mr. PHILLIPS. Yes, Mr. Chairman. I have with me Dr. Walter Parham. He is program Manager for the Food and Renewable Resources Program of the Office of Technology Assessment.

Dr. GAHR. Mr. Chairman, on my immediate left is Mr. Gerald Killian. On my far left is Mr. Walter Hess, both analysts dealing with food and agriculture in GAO.

Mr. SCHEUER. Very good, Dr. Phillips. Let me say to all of you that your prepared remarks will be printed in full at the point in the record at which you testify, so why don't you chat informally with us for 8 or 10 minutes—hitting the highlights of your testimony and feeling free to comment on anything that you heard, either in the last panel or with the USDA witnesses this morning. After you both have done that, and following any further contribution by your associates whom you have kindly brought along, I am sure we will have some questions for you.

STATEMENTS OF DR. MICHAEL PHILLIPS, FOOD AND AGRICULTURAL RESEARCH, OFFICE OF TECHNOLOGY ASSESSMENT; AND DR. WILLIAM GAHR, ASSOCIATE DIRECTOR, COMMUNITY AND ECONOMIC DEVELOPMENT DIVISION, GENERAL ACCOUNTING OFFICE

Dr. PHILLIPS. Thank you, Mr. Chairman.

Members of the committee, thank you for inviting the Office of Technology Assessment to appear before you today. I will, as you suggest, be giving a summary of my statement which, as you indicated, will be supplied in full to the record.

The major participants of the U.S. food and agricultural research system are the U.S. Department of Agriculture, State experiment stations in association with the land-grant universities and the private sector.

Others also involved, which you have heard from today, are 1890 land-grant colleges, also non-land-grant universities, private research institutions, and other Federal agencies, such as the National Science Foundation, Environmental Protection Agency, and National Institutes of Health, just to name a few.

The food and agricultural research system was well conceived by policymakers over 100 years ago and when this system is working properly, it is tremendously effective and I would like to underline that, when the system is working properly, it is the most tremendous research system that the world has ever seen.

Today, however, the food and agricultural research system is not functioning to its full potential, and as we face a future of increased demand on our agricultural resources, it is essential that the research system function to its potential.

The major findings of the OTA assessment are that the research system is working under a number of constraints that diminish its effectiveness and these constraints are lack of well-defined national agricultural goals; lack of a national research priority process, underinvestment in public sector research, confusion over the roles of the research participants and an organizational structure that inhibits the system from having a national research focus.

My remarks will focus on each of these five constraints that I have just mentioned.

First, lack of well-defined achievable and national goals for U.S. agriculture is a major deterrent to the formulation of a national policy that guides the research community in planning its agenda. Present goals are implicit, but ambiguous and open-ended. They range from such statements as "maintaining the food supply," as a goal, to "providing an ample supply of nutritious food for consumers at a reasonable cost with a fair return to the farmer within an agricultural system that is sustainable in perpetuity."

These goals are too vague to be achievable and they raise many questions.

For example, what is meant by an ample supply? It can mean many things. Produce for our domestic consumption, produce for the domestic market plus the world market, produce for all the ones I have just mentioned, plus have concessional food to transfer to the poorer countries of the world. However, how would we know when an ample supply is achieved? What do we mean by nutritious food? What is a reasonable cost to consumers? What is a fair return to farmers? When should we expect to achieve this fair return . . . 1995, 2000, 2500?

What is a sustainable system? Does it tolerate 5, 10, or 15 tons per acre of erosion annually? We don't have answers to these kinds of questions.

These and other questions must be answered for a goal to have a meaning to be useful to the research community in planning a research agenda and to allow for the measurement of how fast then we are achieving these objectives.

However, even if we have goals established, there is a problem in research priority determination. There is no satisfactory long-term process that exists for evaluating research activities, research opportunities and development of research priorities within the food and agricultural system.

Decisions are made on an ad hoc basis with little cooperation among the USDA experimental stations and other agencies conducting research.

This does not mean that there have been no priority studies conducted within a scientific discipline. Many such studies have been conducted by scientists over the year. There have been, however, no followthrough by research administrators in determining research priorities across the scientific disciplines. Some priorities must be moved up.

The research system could benefit from the preparation of a national research agenda that could be updated at scheduled intervals.

The preparation of such agenda, as we have heard mentioned earlier today, would require the involvement not only of researchers and administrators from across all the public sector agencies and private sectors, but also the users of research and representative members of society concerned with the public interest. The methodology for such a study is discussed in the OTA report.

Title XIV of the recently passed Agricultural Food Act which you have heard about earlier today, calls for such an assessment of research priorities and USDA has been designated as the lead agency to conduct the study. It is too early to predict the outcome of this endeavor at this time.

The key ingredient in this long-range plan of research priorities is followthrough. The results of a study such as this must be used for the plan to be effective and it must be an integral part of the appropriations process.

The Appropriations Committees can use the results of such a system which would serve as a guide for the identification of agricultural problems, the research needed to attack these problems, and then the funding required to support this high priority research.

I would now like to move to the third area, which is funding of agricultural research.

Mr. SCHEUER. What page are you on?

Dr. PHILLIPS. Page 4. Over the past decade, we have seen a substantial change in research funding. Despite the fact that USDA is a pioneer and long-time leader in U.S. Government research, the present situation is quite different. Recent USDA expenditures, as you have heard mentioned this morning, are the smallest of any major Federal research agency. If you will note in our prepared statement, in figures (1) and (2), we have updated the information that you have on your chart.

These figures which are updated to 1980, show that USDA's share of the total Federal research expenditures of $31 billion is 1.25 percent. That is 1¼ percent.

And as you indicated earlier, when you opened these hearings, this may be compared to the Department of Defense share which is around 45 percent, the Department of Energy at 15 percent, Health and Human Services at around 12 percent.

The purchasing power of the combined experimental station and USDA agricultural research expenditures has increased about 20 percent in constant dollars, from 1966 to 1980. That is indicated in figure (3) of our prepared statement. The pattern differed sharply, however, for each. USDA real expenditures decreased by 3½ percent while the experiment stations increased by 38 percent.

Moreover, within USDA, between 1966 and 1980, the Agricultural Research Service funds in constant dollars decreased by 7½ percent, and those of the Economic Research Service decreased by 3 percent.

Mr. SCHEUER. That was the point that I made when I talked about the impact of inflation—but I didn't have your precise percentages. I am glad to have those in the record.

Dr. PHILLIPS. Those are indicated in figures (3) and (4) of the charts of our prepared statement. This all comes at a time when the food and agricultural research base has broadened; research requires more sophisticated, expensive equipment and support staff than 10 years ago; and increased costs of scientific equipment have far exceeded the rate of inflation.

If I can take a moment, we can compare the United States to other nations. We see that from 1959 to 1980 the United States had a slight increase in total research expenditures, but total global expenditures in constant dollars increased 3½ times.

If you look at, for example, Western Europe in 1959, public research expenditures were less than half that of the United States. However, by 1980, Western Europe far exceeded the United States.

In 1959, U.S. expenditures represented about 27 percent of the global agricultural research expenditures. By 1980, the U.S. proportion had dropped to 15 percent.

This situation is, nevertheless, the same in terms of scientific manpower as also indicated in Table (1). From 1959 to 1980, total global manpower increased three times. Asia had the largest increase. United States had the smallest increase.

In 1959, U.S. manpower represented about 12 percent of the global agricultural scientific manpower. By 1980, the U.S. proportion had decreased to about 6½ percent.

Now, in all fairness, it must be pointed out that most of the other countries probably needed an increased emphasis on agricultural research during this period.

At the same time, though, the United States was still reaping broad benefits from a past era when research had received greater emphasis.

The fact of what has happened with Federal funding for agricultural research has brought to the surface the concern about equity in public funding of agricultural research.

Sixty-eight percent of the total experiment station expenditures came from State appropriations in 1980 and about 28 percent from

the Federal Government in the form of formula funds and grants as shown in figures (5) and (6) of our prepared statement.

The important thing to note is that since 1966, total Federal Government funding to States has not increased in constant dollars while State appropriations for research have increased 62 percent.

Thus increases in State appropriations have accounted for the increases in the Nation's agricultural research funding.

Mr. SCHEUER. I am sure President Reagan would applaud that.

Dr. PHILLIPS. But this has led to the issue of inequity in the public funding of research. Because State boundaries do not coincide with homogeneous agricultural production regions, research projects in one State which are addressed to specific local problems likely produce results applicable to other States within the same homogeneous production regions. Spillover benefits generated, say by State A, that accrue to the residents of State B, generally are not accounted for by State A policymakers. When such public benefit equally affects the residents of the Nation funding for such research usually can be provided more efficiently by the Federal Government.

There have been some recent developments concerning the measurement of these spillovers: Estimates indicate that about 55 percent of the change of productivity attributed to technology-oriented research is realized within the State conducting the research. The remaining 45 percent was realized in other States. Interregional spillovers of benefits from food and agricultural research are shown in our table (2). These estimats indicated that the aggregate ratios of spillover to regional benefits is 1.73 to 1.

There are regions, you will note, on that table that have ratios higher than 2 to 1. The ratios of Federal-to-State expenditures for food and agricultural research is compared also in table (2) with these ratios of spillovers to regional benefits to determine whether the Federal Government actually financed the spillovers.

These results indicate that the Federal Government financed all the spillover benefits in only three regions. In aggregate, the ratio of Federal to State expenditures is only 1.38 compared to 1.73, the ratio of spillover to regional benefits. The bulk of State-financed research is conducted in the farm belt and because the majority of food consumers are outside of these major producing States, the shift in financial burden for research to the States has meant that taxpayers in food-surplus States are subsidizing consumers in food-deficit States and the degree of the subsidization is increasing steadily.

Another issue related to research funding is how we distribute the funds between USDA and the other participants. These funds are distributed in two primary ways, through a formula mechanism and through grants.

The formula Hatch funds which you have heard mentioned earlier today were first made available to the experiment stations on the basis that it was in the national interest to have an experiment station in each State working on State and local problems. This need still exists and now that we have an improved knowledge of research beneficiaries and spillover effects, the rationale for Federal funding is even greater today. Unlike research in many other fields, much of agricultural research is site specific. Facilities

and professional staff needed for such research should be made available on a continuing basis. Biological research must be continuous to be effective.

Experiment stations are best equipped to manage the solution of State and local problems. Formula funding, which had been a continuing and secure source of funds, has been a mainstay in the development of strong experiment stations. The need continues and is likely to continue in the foreseeable future.

Grant funds provide resources for high-priority research to further the programs of USDA and the Secretary may make grants up to 5 years for either competitive or special research grants. The competitive research grants which are open to all research institutions are useful in providing feasibility in funding research areas that have been identified as high priority or where research indicates that increased effort has a high probability of being successful.

Mr. SCHEUER. Dr. Phillips, we are not going to have time for you to continue reading the remaining half of your statement, because we have another witness and we have to be out of here by 12. I wonder if you could take a couple of minutes to sort of sum up the rest of your testimony?

Dr. PHILLIPS. Sure.

Mr. SCHEUER. Then we can move on to Dr. Gahr.

Dr. PHILLIPS. With regard to competitive grants, they have another advantage in terms of their being able to obtain expertise in certain research areas outside of that that is available within the Experiment Stations and USDA.

As interdisciplinary research becomes more important for future breakthroughs, this type of capability is going to be quite essential and, therefore, grants should be given consideration as a source of increased funds for food and agricutlural research in the future.

The last two constraints on the research system are the roles of the research participants and how each is organized and managed to conduct research. The concern about the roles of the various actors, in terms of State Experiment Stations and USDA in particular, is that these roles have become confused over the years and there is really no general agreement on the roles of the State Experiment Stations and USDA at the administrative level.

There is a concern with regard to the organization and management within USDA to properly carry out the role of UDSA and State Experiment Stations. Essentially we find that ARS, the main USDA research agency, is not structured to manage, conduct, and take responsibility for broad regional and national agricultural research needs in the interest of the United States. We also have concerns within USDA about the Cooperative State Research Service (CSRS) in terms of the way it functions and in being able to carry out its objectives. We also question whether CSRS is the appropriate office to administer the competitive research grants program.

We are very concerned when it comes to human nutrition research within USDA. USDA has not accomplished the intent of Congress with regard to human nutrition research as specified both in the Food and Agricultural Act of 1977 and the Agricultural and Food Act of 1981.

We certainly find that in conclusion that the Food and Agricultural Research System can be described as being in disarray. A need exists for some degree of relatedness among the research participants, particularly between the Experiment Stations and USDA.

USDA, designated by Congress as lead agency, is central to this whole research effort.

Mr. SCHEUER. Central in what way?

Dr. PHILLIPS. Central in the fact that it is the agency that is given the charge for direction of all funds that come from the Federal Government for food and agriculture research and it is more capable in terms of looking at the broad public interest than any other agency within the Federal Government or any other part of the total system.

However, we find that research continues to lack prominence within USDA as witnessed by minimal research funding increases, a continuing decrease in the number of positions assigned to agricultural research, and just in terms of the lack of young scientists that are entering the organization.

A time may have existed when such a situation as exists now might have been tolerable, but it is certainly not the case today. This is a time when food and agricultural problems need to be specifically identified, the research to attack those problems determined, the role of each research participant identified, and the organization of each participant evaluated to determine if it can effectively carry out its role.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Phillips follows:]

STATEMENT OF MICHAEL J. PHILLIPS, Ph.D., PROJECT DIRECTOR
OFFICE OF TECHNOLOGY ASSESSMENT, U.S. CONGRESS
BEFORE THE SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURAL RESEARCH AND ENVIRONMENT
OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

July 27, 1982

Mr. Chairman and Members of the Committee:

Thank you for inviting the Office of Technology Assessment to appear before you today. I am Dr. Michael Phillips, the Project Director of the recently released OTA assessment of the U.S. Food and Agricultural Research System. My purpose today is to summarize the findings of our report, which will provide an overview of the constraints and challenges facing the U.S. food and agricultural research system.

The food and agricultural sector has been extremely successful, partly because of the sustained public support of research and development. As we face a future of increased demand on our agricultural resources, it is essential that the research system responsible for this sector function as effectively as possible.

The major participants of the U.S. food and agricultural research system are the U.S. Department of Agriculture (USDA), State Agricultural Experiment Stations (SAES) in association with land-grant universities, and the private sector. Others also involved include the 1890 land-grant colleges, non-land-grant universities, private research institutions, non-profit organizations, and other Federal agencies, such as the National Science Foundation, the Environmental Protection Agency, and the National Institutes of Health.

The food and agricultural research system was well conceived by policymakers over 100 years ago. When working properly, the system is tremendously effective. Today, however, the food and agricultural research system is not functioning to its full potential.

The major findings of the OTA assessment are that the research system is working under a number of constraints that diminish its effectiveness. These constraints are: 1) lack of well-defined national agricultural goals; 2) lack of a national research priorities process; 3) underinvestment in

11-864 O - 83 - 14

public sector research; 4) confusion over the roles of the research participants; and 5) an organizational structure that inhibits the system from having a national research focus. My remaining remarks will focus on each of these constraints.

1. Lack of Well-Defined National Agricultural Goals

The lack of well-defined, achievable national goals for U.S. agriculture is a major deterrent to the formulation of a national policy that guides the research community in planning its agenda. Present goals are implicit but ambiguous and open-ended. They range from such statements as "maintaining the food supply" to "providing an ample supply of nutritious food for consumers at reasonable cost with a fair return to the farmer within an agricultural system that is sustainable in perpetuity."

These goals are too vague to be achievable. For example, what is meant by an "ample supply"? Does it mean a) produce to meet U.S. demands? b) produce to meet U.S. demands plus economic demands of the world market? or c) produce to meet (b) plus concessional food to poor countries? How would we know when an "ample supply" is achieved? What is "nutritious" food? How is it defined? Is a "reasonable cost" to consumers 15, 20, or 30 percent of the disposable income or some other figure? Is a "fair return to the farmer" 10, 15, or 20 percent on investment? And when should we expect to achieve this "fair return" . . . 1995, 2000, 2500? Is a sustainable system one that tolerates 5, 10, or 15 tons per acre of erosion annually?

These and other questions must be answered for a goal to have meaning, to be useful to the research community in planning a research agenda, and to allow for measurement of how fast we are achieving the objective.

2. Lack of Research Priorities Across Scientific Disciplines

Even if goals were to be established, there is a problem in research priority determination. **No satisfactory long-term process exists for evaluating research activities, research opportunities, and development of research priorities within the food and agricultural system.** Decisions are made on an ad hoc basis with little coordination among USDA, SAES, and other agencies conducting food and agricultural research.

This does not mean that there have been no priority studies conducted within the scientific disciplines. Many such studies have been conducted by scientists over the years. There has been, however, no follow-through by research administrators in determining research priorities across the scientific disciplines. Some priorities must be moved up. Requests for across-the-board increases for each of the disciplines are not convincing to appropriations committees and appear as a defense of the research bureaucracy rather than an earnest effort to solve the problems of agriculture.

The research system could benefit from preparation of a national research agenda that could be updated at scheduled intervals. Preparation of such an agenda would require involvement of not only researchers and administrators but also the users of the research, and consumers themselves. The methodology for such a study is discussed in the OTA report.

Title XIV of the recently passed Agriculture and Food Act of 1981 calls for such an assessment of research priorities, and USDA has been designated as the lead Agency to conduct the study. It is too early to predict the outcome of this endeavor.

The key ingredient in a long-range plan of research priorities is follow-through. The results of the study must be used for the plan to be effective. It must be an integral part of the appropriations process. The

appropriations committees can use the results of this system-wide study as a guide for a) identification of agricultural problems, b) the research needed to attack these problems, and c) the funding required to support this high-priority research.

3. Decreased Federal Funding of Food and Agricultural Research

Over the past decade there has been a substantial change in research funding. Despite the fact that USDA was a pioneer and longtime leader in U.S. Government research, the present situation is quite different. Recent USDA research expenditures have been the smallest of any major Federal research agency, as shown in Figures (1) and (2). **In 1980, USDA's share of the total Federal research expenditures of $31 billion was 1.25 percent. This may be compared to the Department of Defense share at 45 percent, the Department of Energy at 15 percent, and the Department of Health and Human Services at 12 percent.**

Purchasing power of the combined SAES and USDA agricultural research expenditures increased 20 percent in constant dollars from 1966 to 1980, as indicated in Figure (3). The pattern differed sharply, however, for each, as shown in Figure (4): **USDA real expenditures decreased 3.5 percent, while those of SAES increased 38 percent. Moreover, within USDA between 1966 and 1980, Agricultural Research Service funds in constant dollars decreased 7.5 percent, and those of the Economic Research Service decreased 3 percent.**

This has come at a time when a) the food and agricultural research base has broadened, b) research requires more sophisticated, expensive equipment and support staff than even 10 years ago, and c) increased costs of scientific equipment have far exceeded the rate of inflation.

a. United States Compared to Other Nations

Though U.S. funding during this period has increased only slightly,

national research programs of other developed and developing countries have expanded significantly, as shown in Table (1). The most recent figures available indicate that from 1959 to 1980 total global expenditures, in constant dollars, increased three and a half times. The largest increase was in Asia (excluding Japan). The smallest increase was in the United States. In 1959, western Europe public research expenditures were less than half those of the United States; by 1980, western Europe far exceeded the United States. To view the situation from a different perspective, in 1959 U.S. expenditures represented about 27.3 percent of global agricultural research expenditures; by 1980 the U.S. proportion had dropped to 14.9 percent. If privately sponsored research, which is of significant importance in the United States, were included, the situation might be somewhat different, but the same might be true of the developed nations.

The situation is nearly the same in terms of scientific manpower, as indicated in Table (1). From 1959 to 1980, total global manpower increased three times. Asia (excluding Japan) had the largest increase. The United States had the smallest increase. In 1959 African manpower was one-third that of the United States; by 1980, Africa exceeded the United States. Again, to view this from a different perspective, in 1959 U.S. manpower represented 12.2 percent of global agricultural scientific manpower; by 1980, the U.S. proportion had decreased to 6.4 percent.

It must be pointed out that most of the other countries probably needed an increased emphasis on agricultural research during this period. At the same time, the United States was still reaping broad benefits from a past era when research had received greater emphasis.

b. Equity in Public Funding of Research

Sixty-eight percent of total SAES expenditures came from State

appropriations in 1980, and about 28 percent from the Federal Government (USDA, NSF, EPA, etc.) in the form of formula funds and grants, as shown in Figures (5) and (6). Formula funds from USDA accounted for 17 percent of SAES expenditures. Since 1966, total Federal Government funding to States has not increased in constant dollars, while State appropriations for research have increased 62 percent. Thus, increases in State appropriations have accounted for the increases in the nation's agricultural research funding. This has led to issues of equity in public funding of research.

Agricultural research financed by one State may have an impact on the residents of another State. For example, an improved crop variety developed in one State may be adopted in neighboring States to increase yields and total production.

State boundaries do not coincide with homogenous agricultural production regions. Research projects in one State, which are addressed to specific local problems, likely will produce results applicable to other States within the same homogenous production region. Furthermore, knowledge gained from public research is disseminated without regard to geographic boundaries.

Spillover benefits generated by State A that accrue to the residents of State B generally are not accounted for by the State A policymakers. When such public benefit equally affects the residents of the Nation, funding for such research usually can be provided more efficiently by the Federal Government. But Federal-State funding methods generally are not based on the spillover benefits among States and regions.

There have been some recent developments concerning the measurement of spillovers. Evenson et al. (1979) estimated that on the average, 55 percent of the change in productivity attributed to technology-oriented research was realized within the State conducting the research. The remaining 45 percent

was realized in other States. Interregional spillovers of benefits from food and agricultural research are shown in Table (2) (White and Havlicek, 1980). These estimates indicate that the aggregate ratio of spillovers to regional benefits is 1.73. The Northeast and the Appalachian regions have the lowest ratio of spillover to regional benefits. Four regions (Lake States, Corn Belt, Delta, and Southern Plains) have ratios higher than 2 to 1.

The ratio of Federal to State expenditures for food and agricultural research and extension is compared in Table (2) with the ratio of spillovers to regional benefits to determine whether the Federal Government actually financed the spillovers. **These results indicate the Federal Government financed all the spillover benefits in only three regions: Northern Plains, Appalachian, and Mountain. In aggregate, the ratio of Federal to State expenditures is only 1.38, compared to 1.73 for the ratio of spillovers to regional benefits.**

The bulk of State-financed research is conducted in the Farm Belt. Because the majority of food consumers are outside these major producing States, the shift in financial burden for research to the States has meant that taxpayers in food-surplus States are subsidizing consumers in food-deficit States, and the degree of subsidization is increasing steadily.

Another issue related to research funding is the distribution of Federal funds between USDA and the other participants. USDA has the responsibility as the lead Agency for the research program and for working cooperatively with the SAES and other institutions. Since 1916, the relative amount of federally appropriated funds has averaged about 78 percent for USDA in-house research and 22 percent for the States in the form of formula and grant funds. The OTA assessment found no overriding rationale for suggesting a major change in this ratio. There is, however, controversy over the methods of distributing

Federal funds to the States. Funds are distributed in two primary ways: through a formula mechanism and through grants.

Formula Funds. Formula (Hatch) funds were first made available to SAES on the basis that it was in the national interest to have an SAES in each State working on State and local problems. **This need still exists, and now that we have improved knowledge of research beneficiaries and the spillover effects, the rationale for Federal funding is even greater today.**

Unlike research in many other fields, much agricultural research is site-specific, simply because it is so closely related to the problems of a specific area. **Facilities and professional staff needed for such research should be made available on a continuing basis.** Biological research must be continuous to be effective. SAES are best equipped to manage the solution of State and local problems. Formula funding, therefore, which has been a continuing and secure source of funds, has been a mainstay in the development of strong SAES. The need continues and is likely to continue in the foreseeable future.

Grant Funds. These provide resources for high-priority research to further the programs of USDA. The Secretary may make grants up to 5 years for either competitive or special research grants. All colleges, universities, Federal agencies, and private institutions are eligible for competitive research grants. Special research grants are available to land-grant colleges and universities, SAES, and other colleges and universities that have a demonstrable capacity in agricultural research. The main differences between the competitive and special research grant programs are that 1) the competitive grants program is open to all research institutions including those outside of the traditional agricultural research complex, whereas special grants are directed largely toward the traditional agricultural research institutions, and 2) the competitive grants emphasize basic research.

The competitive research grants are useful in providing flexibility in funding research areas that have been identified as high priority because of changing economic conditions or other conditions, or where research indicates that increased effort has a high probability of being successful. Such grant funds are concerned with relatively short-term projects--i.e., 2 to 5 years (even though these may be directed toward long-term problems). Another use of competitive grants is to obtain expertise in certain research areas where it is unavailable from either the SAES or USDA. This advantage is important where it becomes necessary to cross scientific disciplinary lines to make new breakthroughs in science. Such interdisciplinary activities involve technologal approaches not normally associated with agriculture. Information research is one example. Crop planting and irrigation monitored by satellite remote sensing are examples where the use of such information is increasing agricultural productivity. Thus, competitive grants should be given serious consideration as a source of increased funds for food and agricultural research in the future.

4. Confusion Over Roles and Lack of Coordination by Research Participants

At least ten Federal agencies other than USDA fund or conduct some kind of food and agricultural research. These include the Departments of Commerce, Defense, Energy, Health and Human Services, Interior, and State, the Agency for International Development, the Environmental Protection Agency, the National Science Foundation, and the Tennessee Valley Authority. No accurate figures are available for the extent of dollar investment in food and agricultural research by each of these agencies. Some of the budgets are large; other agencies are small and are actually advisory in nature.

Research conducted by these Federal agencies is commonly considered complementary to that of USDA; overlapping efforts are not thought to be great. **However, the degree of overlap and coordination cannot be determined at this time because the mechanism for coordination is not functioning well.**

This coordinating mechanism, known as the Committee on Food and Renewable Resources (CFRR), was mandated by Congress in 1977. The committee, which is chaired by USDA, is primarily charged with improving planning, coordination, and communication among these Federal agencies.

CFRR has not fulfilled these objectives. It does not have a classification of food and agricultural research conducted or funded by these agencies, nor the amount of funds allocated for such research. At present, it does not actively coordinate interagency activities in food and agricultural research.

Over the years, the roles of the USDA and SAES have become very confused. The USDA role has been associated with broad regional, national, and international activities. The role of the SAES, insofar as Federal funds are concerned, has primarily been dealing with local, State, and regional problems. Today, there is considerable overlap; some portions of the Federal and State roles are becoming indistinguishable.

No general agreement exists today on the roles of SAES and USDA at the administrative level. Until some understanding and agreement on the roles of these two primary public sectors is developed, effective agreement on overall cooperation in the important aspects of agricultural research will not result.

State legislatures appropriate funds to their SAES to solve State and local agricultural problems. Accountability for expenditures usually lies with the director of the SAES. Undoubtedly, most State research has contributed to solution of regional and national problems, but such

contributions have been adjuncts to solving State and local problems. It is common for two or more States to pool resources to work on regional problems of common interest. But control and accountability are, for the most part, not centralized in any one person or institution. **It would be difficult for one or several SAES to plan and conduct a full, effective program responsible for solution of regional and national problems, even though they may contribute significantly to the solution of such problems.**

Federal research funds are allocated to USDA primarily for problems of regional or national importance where the nature or magnitude of the problem is such that a single State cannot provide the resources for its solution, where there is some regional or national concern for the problem, or from an industrial standpoint where the risk is too high or demanding for one industrial component. USDA should carry out this role by working as a partner with SAES to achieve complementarity. This should be done with effort by both USDA and SAES to collaborate where appropriate in such a way that it enhances the research performance of both.

5. Ineffective Organization to Address National Research Problems

USDA is not organized to carry out its role. As detailed in the OTA report, USDA does not have an organizational structure that is conducive to focusing on national and regional problems. Consequently, the focus of much research is toward local, State, or multiple-State areas. This means that USDA is missing opportunities in broad issue areas that would complement the research of SAES and, thereby, increase the total research output from both.

a. Agricultural Research Service (ARS)

ARS, the main research agency in USDA, is not structured to manage, conduct, and take responsibilty for broad regional and national agricultural research needs and interests of the United States. When the 1972

reorganization of ARS transferred line responsibility to four regional administrators to be located within each of the four SAES regions, the National Program Staff (NPS) was left without direct-line responsibility for program development, staff selection, and resource allocation. This caused ARS to lose much, if not all, of its ability to plan, manage, and conduct research on broad regional and national problems. The emphasis was placed on the geographical boundaries rather than broad research issues. The national perspective was diminished.

The present regional structure of ARS has little, if any, significance to truly regional research problems. Such problems do not follow State lines, nor do most groups of regional problems fall within the same cluster of States. In contrast, the SAES regions furnish a mechanism for interaction between States sharing a general geographic area. **An ARS organizational structure should, however, be able to relate to an individual State and to the group of States within the SAES regions, and then transcend these boundaries and furnish cohesive and coordinating services and functions on a nationwide scale.** However, under the present structure, responsibility for a given commodity program is highly decentralized. Consider, for example, the case of wheat. Under the present structure, it would appear necessary to conduct the hard red winter wheat research program through the concurrence of the ARS deputy administrators for the Southern, Western, and North-Central regions. It would be necessary also to work through and with seven area research directors and the directors of eleven SAES. The interaction with other regions of the United States where wheat is grown would require an extended layer of regional deputy administrators, area directors, and SAES directors. **This organizational structure has resulted in a dilution of national leadership for national programs and, in effect, substituted a series of**

programs oriented to local, State, or several-State areas. It also accounts for approximately 35 percent of the ARS budget. This is an exorbitant share of the budget for nonscientific staff.

b. Cooperative State Research Service (CSRS)

CSRS is responsible for administering formula funds, special grants, and competitive grants. It conducts project reviews of activities that are supported by formula (Hatch Act) funds, but these reviews are more of a formality than an in-depth examination. As a part of the process, on-site reviews are held every 3 to 5 years at the request of the client institution. Their value rests mainly on actions taken by the institution being reviewed, since CSRS has no follow-up responsibilities. Further, CSRS has little authority in dealing with SAES. CSRS has at times tended to operate as though it were under the supervision of SAES, rather than that of the Secretary of Agriculture.

It is questionable whether CSRS is the appropriate office to administer the competitive research grants. All U.S. research institutions and research scientists having expertise and capabilities are supposed to be considered equally as pote tial grantees. Having the grants administered by one agency whose function is so closely tied to one segment of the research community is reason for concern.

c. Human Nutrition Research

USDA has not accomplished the intent of Congress with regard to human nutrition research as specified in the Food and Agriculture Act of 1977 and in the Agriculture and Food Act of 1981. These laws for the first time singled out human nutrition research as essential to USDA's mission. USDA was designated the lead Agency in the Federal Government for human nutrition research (except for biomedical aspects of human nutrition research concerned

with diagnosis or treatment of disease). The Carter Administration attempted to meet this congressional mandate by establishing within USDA an organizational structure--the Human Nutrition Center--to administer and coordinate all human nutrition research and information within USDA. In addition, the Office of Science and Technology Policy formed a Joint Subcommittee on Human Nutrition Research, which made many efforts to coordinate human nutrition research activities throughout the Federal Government. Only part of these activities met with success; nevertheless, the effort was moving to meet the intent of Congress.

The present administration has dismantled the USDA Human Nutrition Center by decentralizing its nutrition research program and separating its nutrition information functions from the nutrition research functions. Five human nutrition research centers were transferred to the ARS, where they now are administratively under the four separate regional ARS administrators. The sixth, the Consumer Nutrition Center, was transferred to a different Assistant Secretary and folded into a new Agency--the Human Nutrition Information Service (HNIS). **Such segmentation of research inhibits the ability of USDA to develop a coordinated national research program.** Now, nutrition research might become focused, for example, on agricultural products of a region rather than on basic human conditions and related nutritional needs, e.g., infancy, pregnancy, lactation, and aging. With the transfer to California of the ARS National Program Staff scientist responsible for nutrition, a central focus is lacking for nutrition research planning within ARS. Further, little, if any, joint planning exists between ARS and HNIS.

There is also concern about the functioning of the five human nutrition research centers. They have been hampered by low levels of funding and a severely restricted number of positions for professional staff, especially at

the three newest centers. USDA professional staff at these three centers total six, and an additional twelve positions remain empty. ARS stated at the June 23, 1982 joint hearings on Federal commitment to human nutrition research (of the Subcommittee on Science, Research and Technology and the Subcommittee on Department Operations, Research and Foreign Agriculture) that the Center for Aging at Tufts will become solely a contract operation. The Children's Nutrition Research Center at Baylor is also moving in this direction. **With such changes, there is an even greater necessity for good research planning and coordination.** It is unclear how a director of a research center who is not a USDA employee, but rather an employee of the cooperating institution, would interact with the USDA administrator. The relationship would seem to be that of a contractor-contractee rather than that of the usual chain of command.

Under the present administration, there has been little, if any, effort to coordinate human nutrition research among Federal agencies. This inhibits the development of an effective Federal human nutrition research program.

Concluding Comments

Today the food and agricultural research system can be described as being in disarray. A need exists for some degree of relatedness among the research participants--particularly between SAES and USDA. Improved leadership is essential. USDA, designated by Congress as lead Agency for food and agricultural science, is central to the research effort. USDA is directly involved in acquisition and distribution of Federal funds to the States, other research institutions, and its own in-house research. It coordinates with other Federal agencies and comes closer to perceiving the broad public interest than does any other segment of the research system.

However, research continues to lack prominence within USDA as witnessed by minimal real research funding increases, a continuing decrease in the number of positions assigned to agricultural research, and the lack of young scientists in the organization. Scientists 50 years of age or older account for almost 50 percent of all ARS scientists, whereas those 30 years of age or younger account for only 2 percent. NIH, in comparison, has only 15 percent of its scientists 50 years of age or older, and about 25 percent 30 years of age or younger.

SAES prefers a loose, voluntary, cooperative type of guidance from Washington, with few, if any, strings attached. However, leadership and coordination of the research system must be exercised if the system is to appear to Congress as something other than bureaucratic self-seekers. This does not mean that USDA or any other Federal agency should be coordinating or supervising research conducted by SAES with State or privately supplied funds.

In his Cosmos Club lecture of April 1980, Dr. John W. Gardner addressed the subject of "The War of the Parts Against the Whole." He noted the continued development of various "groups" that expanded in number and diversity since World War II--and in their capacity to organize for combat.

He concluded his lecture with the following comment:

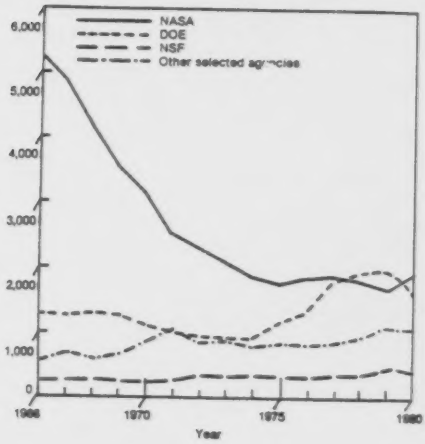
> "Our pluralistic philosophy invites each organization, institution, or special group to develop and enhance its own potentialities. But the price of that treasured autonomy and self-preoccupation is that each institution concern itself also with the common good. That is not idealism: it is self-preservation. The argument is not moralistic. If the larger system fails, the subsystems fail. That should not be such a difficult concept for the contending groups to understand."

A time may have existed in which the sort of situation present in today's agricultural research system could be indulged. Today is not that time. Today is a time for leadership to emerge from within the system and for each

of the component parts to work together for the good of the system. This is a time when the food and agricultural problems need to be identified, the research to attack those problems determined, the role of each research participant identified, and the organization of each participant evaluated to determine if it can effectively carry out its role. Only then will the research community be able to merit and obtain the resources needed to meet the food and agricultural challenges of the future.

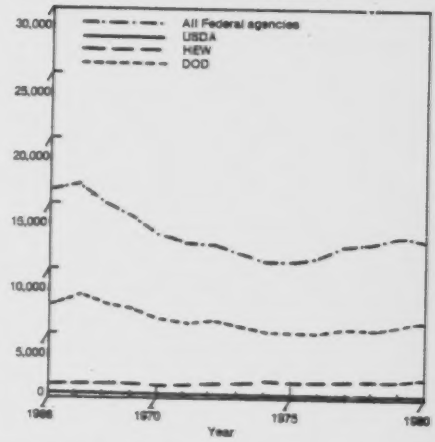
11-864 O - 83 - 15

Figure 1.—Federal Obligations for R&D by NASA, DOE, NSF, and Other Selected Agencies—1966-80
(In millions of constant dollars)



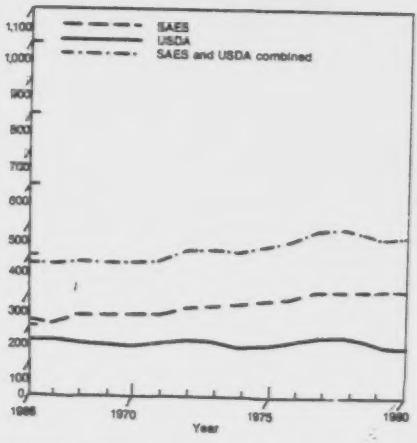
SOURCE: Office of Technology Assessment.

Figure 2.—Federal Obligations for R&D by USDA, DOD, HEW, and All Federal Agencies—1966-80
(In millions of constant dollars)



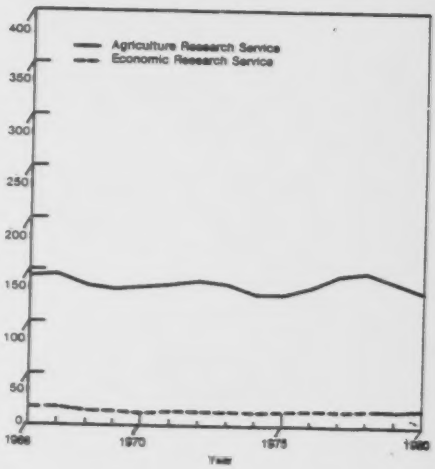
SOURCE: Office of Technology Assessment.

Figure 3.—SAES, USDA, and Combined SAES and USDA Total Research Expenditures—1966-80
(In millions of constant dollars)



SOURCE: Office of Technology Assessment.

Figure 4.—USDA Research Expenditures by ARS, ERS—1966-80 (In millions of constant dollars)



SOURCE: Office of Technology Assessment.

Table 1.—Public Expenditures on Agricultural Research and Manpower, Major Regions of the World, 1959 and 1980

Region/country	Expenditures[a] (in millions of constant 1980 dollars)			Manpower (SMYs)		
	1959	1980	Change (percent)	1959	1980	Change (percent)
Asia (excluding Japan)	$125.7	$1,050.3	736%	4,218	30,985	635%
Japan	135.4	684.3	405	7,200	15,671	118
Western Europe	275.0	1,489.6	442	6,251	19,540	213
Latin America	79.6	462.6	481	1,425	8,534	499
Canada, Australia, and New Zealand	196.2	628.0	220	2,700	5,138	90
U.S.S.R.[b]	372.4	939.4	152	12,000	31,394	162
Eastern Europe[b]	195.9	553.4	182	5,701	20,220	255
Africa	119.1	424.8	257	1,919	10,073	425
United States	564.2	1,094.3	94	5,740	9,688	69
World total	$2,063.5	$7,326.7	255%	47,154	151,243	221%

[a]Does not include expenditures on international agricultural research centers.
[b]1980 data is estimated from earlier data.

SOURCE: Compiled from James K. Boyce, M. Ann Judd, and Robert E. Evenson, "Inter-Country and Inter-Regional Comparisons of the Allocation of Resources to Agricultural Research and Extension," Yale University, Economic Growth Center, unpublished, 1982.

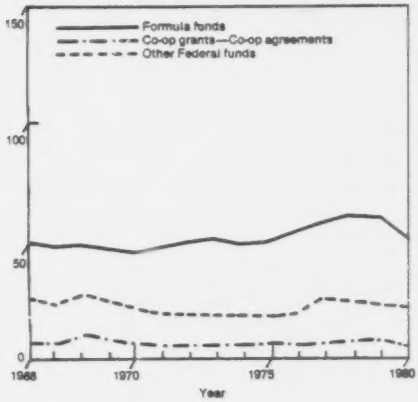
Table 2.—Regional Estimates of External-to-Internal Ratios Related to Benefits and Funding of Production-Oriented Agricultural Research and Extension

Region	Ratio of spillovers to regional benefits	Ratio of Federal-State expenditures[a]
Northeast	1.31	0.97
Lake States	2.73	1.10
Corn Belt	2.04	1.25
Northern Plains	1.40	1.63
Appalachian	1.19	1.60
Southeast	1.40	1.37
Delta	2.48	1.80
Southern Plains	2.80	2.10
Mountain	1.60	2.35
Pacific	1.89	0.90
Aggregate	1.73	1.38

[a]Includes Federal funding of production-oriented agricultural research and extension in each region through SEA/CR, SEA/AR, SEA/EXT, USDA/ESCS, and USDA/SCS relative to State expenditures for agricultural research and extension in each region.

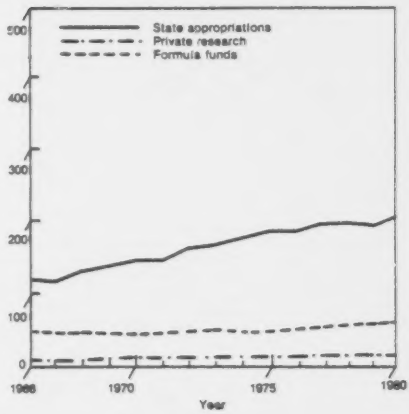
SOURCE: Fred C. White and Joseph Havlicek, Jr., "Interregional Spillover of Agricultural Research Results and Intergovernmental Finance." Paper presented at Symposium on Methodology for Evaluation of Agricultural Research, Minneapolis, Minn., May 12–13, 1980.

Figure 5.—Formula, Cooperative Grants and Cooperative Agreements, and Other Federally Funded Research Expenditures at SAES—1966-80 (In millions of constant dollars)



SOURCE: Office of Technology Assessment.

Figure 6.—State Appropriations, Private Research, and Formula Funds at SAES—1966-80 (In millions of constant dollars)



SOURCE: Office of Technology Assessment.

Mr. SCHEUER. Well, that was a very interesting testimony, Dr. Phillips, and we will have some questions for you in a few minutes. Again I am very glad that the top officials in the Department of Agriculture have given us their time and interest to stay here and hear your testimony.

Dr. Gahr, why don't we hear from you now and, if you can, just chat with us for 8 or 10 minutes without reading your testimony because it will be printed in its entirety at this point in the record. After 8 or 10 minutes, we would like to get on with questions.

Dr. GAHR. Thank you. I think I can summarize this quite quickly. We are pleased to be here today.

We have done five studies over the past 2 years on agricultural research development and extension.

We are cognizant that the Federal-State partnership has given us a very strong system and in the past has provided us with improved production and marketing techniques.

Recently, however, there have been a number of concerns that have been raised in the general public that our new technology is not keeping pace with basic needs.

The five studies that I would like to briefly summarize deal with one, long-range planning and R&D and; two, management of plant genetic resources; three, activities of the cooperative extension service; four, nutrition research; and five, personnel needs in food and agricultural sciencies.

The first study on long-range planning was issued in July of 1981. It dealt with long-range planning and we reported that the Department of Agriculture does not perform long-range planning for agricultural research which would generally satisfy the accepted definitions of such planning. Most of the agricultural research planning that is done is not national long-range planning and no rationale for such planning has been developed.

Current planning efforts primarily involve short-term or operational planning.

A number of factors inhibit in-house long-range planning. They include one, a general belief by agricultural scientists that long-range planning is a luxury and cannot be afforded; two, that concern by the States that a stronger USDA research planning effort may eventually lead to Federal centralized control of State research operations; and three, frequent changes in departmental leadership.

Given these inhibitions, we felt it was unlikely that a national long-term planning effort for R&D could be undertaken immediately, but we suggested to the Department that a needs assessment of food and agriculture be conducted and a determination made of the research alternatives that could assist in meeting those needs.

The Department agreed with that general suggestion and the Joint Council on Food and Agricultural Sciences has issued an RFP and is receiving proposals to conduct such a needs assessment.

The second report deals with germplasm. This is a specifc research area we feel is very important. It deals with the USDA management to preserve our basic genetic stock, or germplasm, of domestic and wild food plants from which all primary crops are grown.

Over the years, the genetic base of our Nation's crops has become increasingly narrow and presents a potential danger to U.S. crop production. If genetically uniform characteristics in plants are suddenly adversely affected by disease, insects, or poor weather, the losses could be substantial. We have issued two reports on germplasm; the first one assessed the overall management of germplasm and the second one addressed specific operational problems. The first report on germplasm concluded that the germplasm system does not determine the risks of genetic vulnerability or adequately perform the housekeeping chores of collection, maintenance, and evaluation of germplasm.

The system's inadequacy was primarily attributable to the decentralized management of germplasm resources which effectively prohibit the development and implementation of an integrated germplasm development, maintenance, and research program.

We recommended that the Secretary place planning, budget, and other management functions for germplasm activities under a central authority within the Science and Educational organization. We also recommended that the Secretary develop a comprehensive plan to assess the genetic vulnerability of U.S. crops; determine gaps in existing germplasm collections; assure that desired genetic characteristics of individual species are made available; and develop an information system for disseminating information on collections and evaluations.

The Department made changes to provide a better focal point for such management and agreed with our recommendation that a comprehensive plan for genetic resources should be established.

The second report dealing with collection, storage, and maintenance problems concluded that these problems endanger the Nation's germplasm resources. We recommended that the Secretary address these operational problems and implement the policy for backup storage; inventoring; and updating the small grains collection and assuring that germplasm is adequately stored, monitored, and replenished as needed.

The Department has agreed with our conclusions and is taking some action in that regard.

The third report deals with the Cooperative Extension Service. This is an August 1981 report in which we pointed out that the Department's Extension Service originally focused on agriculture and home economics subjects primarily in rural areas, but that the range of programs offered and the audiences served has broadened substantially. Now the Extension Service is active in rural, urban, and suburban communities and conducts a wide range of activities.

As more programs vie for the Service's resources, disagreements have occured over its mission. Some groups believe that it is ignoring their needs. Others say it is trying to be all things to all people. We saw a need to reexamine the Cooperative Extension Service's mission, including the appropriate Federal role. We also highlighted program, clientele, funding, and organizational issues that need to be reviewed.

To this end, the Secretary of Agriculture and the president of the National Association of State Universities and Land Grant Colleges established a Joint Committee on the Future of Cooperative Extention which is charged with developing recommendations on the appropriate mission, scope, priorities, and future direction of the Extension Service. This committee is expected to issue its report this year or early 1983.

The fourth report deals with human nutrition, research and planning. This is a May 1982 report. We stated that the Federal Government does not yet have an overall Federal nutrition research plan that identifies goals with unified and coordinated strategies. The Office of Science and Technology Policy has been a major contributor to and catalyst for improved conditions through its Joint Subcommittee on Human Nutrition Research. This subcommittee is made up of representatives from seven major departments, including the Departments of Agriculture and Health and Human Services. In December 1980, the joint subcommittee issued a report which is the first step toward developing a Federal nutrition research plan. However, the six areas discussed in the subcommittee's report should be further developed and expanded into a single research plan which would include an assessment of needs priorities and strategies.

OSTP and the Departments of Agriculture and Health and Human Services agreed in principle with the recommendation for a Federal nutrition research plan and OSTP told us recently it is the intention of the joint subcommittee to update and expand its 1980 report.

The fifth report is one on personnel needs in agricultural sciences. This was issued in December 1981. We pointed out the Department of Agriculture's Office of Higher Education was interacting with university representatives to identify issues and concerns related to the graduates in the food and agricultural sciences, but it was not interacting with industry and Federal agencies that also used such personnel.

As a result, it was not obtaining an accurate and up-to-date profile of the supply and demand picture of personnel requirements for food and agricultural science personnel.

We recommended, and the Department said it would be especially cognizant to obtain, input from industry representatives as well as other Federal agencies in developing future science personnel needs.

That concludes my statement, Mr. Chairman.

[The prepared statement of Dr. Gahr follows:]

United States General Accounting Office
Washington, D.C. 20548

FOR RELEASE ON DELIVERY
EXPECTED AT 9:00 A.M. EDT
TUESDAY, JULY 27, 1982

Statement of
William E. Gahr, Associate Director
Community and Economic Development Division

Before the
Subcommittee on Natural Resources, Agriculture
Research and Environment
House Committee on Science and Technology

on

General Accounting Office Reviews of Agricultural Research and Development and Extension Activities

Mr. Chairman and Members of the Subcommittee:

We are pleased to be here today at your request to discuss the results of our major reviews during the past few years relating to Department of Agriculture research, development and extension activities. As you know, agriculture plays an important role in U.S. society, and food and agricultural research and extension has made a significant contribution to the agricultural sector. The Federal/State research and extension partnership has given us new and better ways to improve production, processing, and marketing of food as well as helping solve problems in environmental quality and human nutrition. Today, however, scientists are concerned that new technology may not be keeping pace with domestic and world food needs.

During the past two years we have completed several major studies dealing with agricultural research and extension activities. These include (1) long-range planning for agricultural research and development, (2) management of plant genetic resources--or

germplasm, (3) activities of the cooperative extension service, (4) nutrition research planning and coordination, and (5) personnel needs in the food and agricultural sciences. I will now briefly summarize the studies we have done in each of these areas.

LONG-RANGE PLANNING FOR AGRICULTURAL RESEARCH

Our July 21, 1981, report entitled "Long-Range Planning Can Improve The Efficiency of Agricultural Research and Development" (CED-81-141) dealt with the need to improve long-range planning for agricultural research. We reported that the Department of Agriculture does not perform national long-range planning for agricultural research which would satisfy generally accepted definitions of such planning. Essentially such planning entails establishing long-range goals, selecting strategies for achieving those goals, setting priorities, and preparing a series of short-range plans to accomplish the goals. The key research participants --the Department of Agriculture, the land-grant colleges, and State agricultural experiment stations--do engage in some aspects of national long-range planning but only to a limited extent. Most of the agriculture research planning that is done is not national long-range planning and no rationale for such planning has been developed. Current planning efforts primarily involve short-term or operational planning.

USDA has attempted to set goals for USDA-conducted research, has done long-range planning for individual inhouse research topics, and has developed operational plans for inhouse research, but these efforts have not resulted in a national long-range plan.

A number of factors inhibit national long-range planning. These include (1) a general belief by agricultural scientists that long-range planning is a "luxury" and cannot be afforded; (2) concern by the States that a stronger USDA research planning effort would eventually lead to Federal planning and control of State research operations; and (3) frequent changes in departmental leadership with limited executive interest and guidance in long-range planning.

We concluded that it was unlikely that national long-range planning efforts for agricultural research and development can be immediately undertaken given the inhibiting factors facing the system. We said that a better approach would be for Agriculture and State research organizations to cooperate in developing a first step in long-range planning--making a food needs assessment and determining the research alternatives that would assist in meeting those needs.

The Department of Agriculture agreed that long-range planning is one of the ways to maintain and improve agricultural research and development and that the Joint Council on Food and Agricultural Sciences would conduct a food and agriculture needs assessment. The Department issued a request for proposals on the needs assessment and is now in the process of reviewing proposals for this project.

THE DEPARTMENT OF AGRICULTURE'S GERMPLASM PROGRAM

One specific research area which we feel is important is the Department of Agriculture's management of a program to help preserve the base stock--or germplasm--of domestic and wild food

plants from which all primary crops are grown. Over the years, the genetic base of this Nation's crops has become increasingly narrow which presents a potential danger to U.S. crop production. If genetically uniform characteristics in plants are suddenly adversely affected by disease, insects, or poor weather, the potential crop losses could be substantial.

We have issued two reports dealing with germplasm. In our April 10, 1981, report entitled "The Department of Agriculture Can Minimize the Risk of Potential Crop Failures" (CED-81-75) we assessed the overall management of the germplasm system. In our December 4, 1981, report entitled "Better Collection and Maintenance Procedures Needed To Help Protect Agriculture's Germplasm Resources" (CED-82-7) we addressed specific operational problems associated with the Department's germplasm program.

Because the Nation's major crops have been developed from plants not native to the United States, the Department, in association with State experiment stations, land-grant colleges, and private curators (germplasm storekeepers) has long maintained a series of germplasm storage units which generally collect, store, and distribute plant germplasm. This system--the National Plant Germplasm System--is supposed to meet national needs for plant genetic resources.

In our April 1981 report we concluded that, as currently organized and managed, this system does not determine the risks of genetic vulnerability or adequately perform the housekeeping chores of collection, maintenance, and evaluation of germplasm stock. The system's inadequacy was primarily attributable to the

decentralized management of germplasm resources, which effectively prohibited the development and implementation of an integrated germplasm development, maintenance, and research program.

We recommended that the Secretary of Agriculture place planning, budget, and other management functions for the Department's germplasm activities under a central authority within its Science and Education organization. We also recommended that the Secretary develop a comprehensive plan to assess the genetic vulnerability of U.S. crops; determine gaps in existing germplasm collections; assure that desirable genetic characteristics of individual species are made available; and develop an information system for disseminating information on collections and evaluations.

The Department made management changes to provide a better focal point for program management. Further, the Department agreed with our recommendation that a comprehensive plan for genetic resources should be developed and established a working group to develop such a plan. The plan has been completed and is currently under review by the National Plant Germplasm Committee.

In our December 1981 report we concluded that a number of collection, storage, and maintenance problems seriously endanger this Nation's germplasm resources. These include inadequate backup storage for the germplasm system, inadequate storage conditions for many of the germplasm collections, curators who are behind in replenishing their germplasm or lack equipment to determine when the germplasm needs to be replenished, and serious gaps due to missing or depleted stocks in the small grains collection.

We recommended that the Secretary of Agriculture address the operational problems of the National Plant Germplasm System. His actions should include implementing a policy for backup storage; inventory and update the small grains collection; and assuring that germplasm is adequately stored, monitored, and replenished as needed.

The Department agreed with our conclusions and recommendations and is taking certain corrective actions, including an update of the backup storage system and the establishment of site assessment teams to assess the specific storage and maintenance problems at the germplasm collection sites.

ACTIVITIES OF THE
COOPERATIVE EXTENSION SERVICE

In our August 21, 1981, report on extension activities entitled "Cooperative Extension Service's Mission and Federal Role Need Congressional Clarification" (CED-81-119) we pointed out that the cooperative extension service--which is made up of the Federal Extension Service in the Department of Agriculture, the State Extension Services located within the land-grant colleges and universities, and local offices in virtually every county--originally focused on agriculture and home economics subjects in primarily rural areas, but that the range of programs offered and audiences served by the Service has broadened substantially, especially during the past two decades. The Extension Service, which has considerable local programming flexibility, is now active in rural, urban, and suburban communities and conducts programs in social and economic problems and cultural,

recreational, and leisure time activities as well as in more traditional subjects.

The Extension Service was established in 1914 primarily to provide farmers with information from agricultural research and to encourage them to adopt improved farming methods. Its legislative mandate is broad enough, however, to allow for different interpretations of what the Service ought to be doing and for whom.

As more programs vie for the Service's resources, disagreements have occurred over its mission. Some groups believe it is ignoring their needs; others say it is trying to be all things to all people. Differing opinions about the scope of its mission are voiced even within the Service itself. The Department of Agriculture's role in providing overall program leadership and guidance in evaluating extension activities is also not clear.

We saw a need to reexamine the Cooperative Extension Service's mission, including the appropriate Federal role. We also highlighted program, clientele, funding, and organizational issues that we believed needed to be reviewed.

The Department of Agriculture agreed that clarification of the Service's mission would be most helpful and appropriate. To this end the Secretary of Agriculture and the President of the National Association of State universities and land-grant colleges established, in January 1982, a Joint Committee on the Future of Cooperative Extension which is charged with developing recommendations on the appropriate mission, scope, priorities, and future

direction for the Extension Service. The Joint Committee is expected to issue its report in late 1982 or early 1983. Furthermore, the Subcommittee on Department Operations, Research, and Foreign Agriculture of the House Committee on Agriculture, held oversight hearings on the Cooperative Extension Service during February and March 1982. A report on these hearings is currently being written.

FEDERAL HUMAN NUTRITION
RESEARCH PLANNING AND COORDINATION

In our May 21, 1982, report entitled "Progress Made in Federal Human Nutrition Research Planning and Coordination; Some Improvements Needed" (CED-82-56), we stated that the Government does not yet have an overall Federal nutrition research plan that identifies specific goals with unified and coordinated strategies. The Departments of Agriculture and Health and Human Services, along with the Office of Science and Technology Policy have made strides in the latter half of the 1970's in laying the groundwork for a coordinated research planning system. Nine Federal departments and agencies, covering diverse areas such as nutrition research, food regulations, education, and information, have been working together to facilitate communication and effective and efficient use of resources.

The Office of Science and Technology Policy has been a major contributor to, and catalyst for, improved coordination of nutrition research through its Joint Subcommittee on Human Nutrition Research, which is made up of representatives from the Departments of Agriculture and Health and Human Services and seven other departments and agencies. In December 1980 the Joint Subcommittee

issued a report entitled "Human Nutrition Research and Training". This report is a first step toward developing a Federal nutrition research plan. However, the six research areas discussed in the subcommittee's report should be further developed and expanded into a single research plan which would include an assessment of needs, priorities, and strategies.

We recommended that the Director of the Office of Science and Technology Policy direct the Joint Subcommittee on Human Nutrition Research to develop a Federal nutrition research plan by updating and expanding its December 1980 report on federally supported human nutrition research. The subcommittee and the Federal departments and agencies should work together to develop specific goals, objectives, and strategies, and to identify their responsibilities and the required resources and time frames to accomplish the research goals.

The Office of Science and Technology Policy, and the Departments of Agriculture and Health and Human Services agreed in principle with our recommendation for a Federal nutrition research plan. The Office of Science and Technology Policy told us recently that it is the intention of the Joint Subcommittee to update and expand its 1980 report and to use it as the vehicle for evolving a broad Federal nutrition research plan.

PERSONNEL NEEDS IN THE
FOOD AND AGRICULTURAL SCIENCES

In our December 28, 1981, report entitled "Lead Agency Responsibilities To Keep Informed of Personnel Needs in the Food and Agricultural Sciences Are Not Being Fully Met" (CED-82-25), we pointed out that the Department of Agriculture could do a

better job in carrying out its responsibilities as the Federal Government's lead agency for keeping abreast of personnel needs in the food and agricultural sciences. The Secretary of Agriculture, who was assigned such responsibilities under the Food and Agriculture Act of 1977 created an Office of Higher Education in 1978 to carry out these responsibilities.

We found that this Office was interacting with university representatives to identify issues and concerns related to the need for graduates in the food and agricultural sciences. However, it was not interacting with industry and Federal agencies that also use such personnel. As a result, it was not obtaining an accurate and up-to-date profile of the overall supply/demand picture and personnel development requirements for food and agricultural science personnel.

We recommended that the Secretary of Agriculture, through the Office of Higher Education, interact with a cross section of organizations (industry and Government agencies, as well as universities) that employ graduates trained in food and agriculturally related sciences. The Department of Agriculture said that the observations in our report are useful to the Department in discharging its responsibilities as the lead agency in monitoring personnel needs for the food and agricultural sciences. The Department said also that it will be especially cognizant to obtain input from agricultural industry representatives as well as interact with other Federal agencies in developing future assessments of food and agricultural science personnel needs.

This concludes my statement. My colleagues and I would be happy to respond to any questions you might have.

11-864 O - 83 - 16

Mr. SCHEUER. I appreciate your very fine testimony.

Dr. Phillips, you mentioned title XIV of the Agriculture and Food Act of 1981 calls for an assessment of long-term research needs and designates the USDA the lead agency to conduct that study.

You say it is too early to predict the outcome of this endeavor. Does the law provide a particular timeframe in which they are expected to complete a study and formulate some specific leadership plans, or is that left fuzzy?

Dr. PHILLIPS. I am not exactly sure of the timeframe per se. They have at least until the farm bill expires, which would be in 1985, to produce such a report.

My recollection is that it is to be completed within the next year and a half to 2 years.

Mr. SCHEUER. Could one of the gentlemen from the USDA tell us exactly when that assessment of research needs or priorities is due?

Dr. KINNEY. January 1984.

Mr. SCHEUER. January 1984?

So there are approximately 18 months left for that to be accomplished? Could either of you tell us how USDA is meeting that mission?

Dr. PHILLIPS. Mr. Chairman, they have essentially assigned that task to the Joint Council on Food and Agricultural Sciences and the Council is in the process now of developing the methodology for the study. They have put out RFP's with regard to contracts on that. As far as I know, that at the present time is the status. They are essentially doing a lot of the preparatory work.

Mr. SCHEUER. Was that a reasonable assignment of that mission, do you feel? Is that joint body equipped to perform that needs assessment and subsequent determination of research priorities?

Dr. PHILLIPS. It is a very difficult thing, I believe, for the Joint Council to do, to do in a very comprehensive fashion, particularly as we discuss it in the methodology presented in the OTA report.

In terms of funding for that, to my knowledge they have not received any additional funds to conduct it. You will have to ask them to be more specific about that, but they have quite a mandate already that has been given to them by Congress in terms of just coordinating the research activities and developing what the roles are of the various participants.

Now, they have also been asked by the Secretary to take on this job of performing this needs assessment which is to be very comprehensive. It will be a challenge for the Joint Council.

Mr. SCHEUER. Mr. Assistant Secretary, I wonder when you could come back and tell us how you are responding to these three studies? I am sure that this report and the assignment of this needs assessment and research requirements will enter into your comments and report to us.

Could you give us some specific information on any increased funding you are providing for the Joint Council on Food and Agricultural Sciences to perform this important job that you have assigned to them?

Is it expected they will do that in addition to everything else they are doing with their present staff? What kind of additional re-

sources are you making available to them to do this job that presumably will be completed within the next 18 months?

Dr. KINNEY. Would you like that now, Mr. Chairman?

Mr. SCHEUER. No; but if you could do that when you give us the information that we discussed earlier on how you are reacting to the mandate of the law and the suggestions in all of these reports we would appreciate it. We are quite interested in knowing what kind of additional manpower and scientific personnel they have been given to perform this very significant role. If you could provide that we will insert it in the record at this point.

[The information follows:]

JOINT COUNCIL NEEDS ASSESSMENT STAFF AND FUNDING

There has been no increased funding to the Council, however, $187,000 of the Assistant Secretary's program evaluation money has been provided for a contract to develop some of the background material for the needs assessment. At the present time, one staff person is working on the needs assessment on a full-time basis.

Dr. Gahr, can you elaborate on your analysis of the status of establishing measurable national goals and the mechanisms necessary to meet those goals?

Dr. GAHR. Mr. Chairman, as we said in two different reports, one on long range planning and one on nutrition research, establishing specific goals is very important.

Without specific goals, it is difficult for the research organizations to be singing from the same sheet of music. The needs assessment that the Joint Council is beginning is the first step in that entire process.

Mr. SCHEUER. What kind of progress has been made by the Joint Council on that?

They are proceeding with the RFP. There is a two-phase process in this. They will receive proposals on the RFP and conduct the needs assessment through the Joint Council.

I believe the staff within USDA itself will conduct the second phase. There will be two parallel projects. We think it is a positive first step.

In terms of nutrition research, we think the OSTP's Joint Subcommittee on Nutrition is also stepping forward and has just recently issued a second report that complements what they issued in 1980. They are proceeding and, of course, we would like to see them move faster. We would like to see more specific goals and we would certainly like to see goals get to a point where they are measurable.

None of the goals established so far can be categorized as measurable.

Mr. SCHEUER. In order for those goals to be a realistic tool in developing policy and assigning missions and establishing priorities, don't they have to be measurable? Don't they have to be quantifiable?

Dr. GAHR. We would like them to be measurable; we would like to see them quantified.

The Federal, State, and county consensus process of setting goals could make them measurable, but it is a very difficult job.

Mr. SCHEUER. It is very difficult. It does involve input from each of the segments of this very pluralistic agricultural research community, so it is a difficult, perplexing problem.

I guess it is very important that it be done and that it be done right so that what we get is a tool for developing policy and priorities.

We have had the second bell of a rollcall vote. We have gone past our designated hour. Let me thank this panel for its excellent testimony. We will have some additional questions for you, and let me thank all of the witnesses. We have had two remarkable panels and fine testimony. I am particularly appreciative that the USDA personnel stayed throughout the morning because I am sure that the testimony stimulated their cerebral processes, as it has stimulated ours.

That is what these hearings are all about.

Thank you for making this such a productive hearing.

The committee is adjourned.

[Whereupon, at 12:10 p.m., the subcommittee was adjourned, to reconvene at 9 a.m., Wednesday, July 28, 1982.]

THE NATION'S LONG-TERM AGRICULTURE RESEARCH NEEDS

THURSDAY, JULY 29, 1982

HOUSE OF REPRESENTATIVES, COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURAL RESEARCH AND ENVIRONMENT,

Washington, D.C.

The subcommittee met, pursuant to adjournment, at 1:30 p.m., in room 2318, Rayburn House Office Building, Hon. James H. Scheuer (chairman of the subcommittee) presiding.

[The opening statement of Hon. Claudine Schneider follows:]

OPENING STATEMENT OF HON. CLAUDINE SCHNEIDER

Thank you, Mr. Chairman, while these 2 days of hearings are focused on the examination of the current and future ability of the agricultural research system in this country to meet the national long term needs, some criticism of hearings of this nature may be heard: Why are we looking at research when the United States has such a surplus of grain? One answer lies in the comparison of United States and U.S.S.R. agriculture.

In May 1978, the Central Intelligence Agency indicated the similarities and differences between the Soviet and the United States' grain-producing areas, the latter accounting for the lower yields obtained by the U.S.S.R. To date, their report remains unchanged:

"The Soviets have not fully exploited their potential for developing a cornbelt type agriculture such as found in the United States for producing corn and grain sorghum. Deficiencies in grain production technology, are responsible for this low grain yield, as well as the lack of increased application of proper and sufficient fertilizer and irrigation.

"The Soviets lag severely in the introduction of modern crop varieties, in the application of fertilizers and other agricultural chemicals, in providing sufficient farm mechanization and pest controls, and the selection of tillage and harvesting practices. Restrictive institutional practices, including unwarranted restrictions on the use of fallowed land and on the types of grain sown, also impede increases in grain production."

Soviet press reports about shortcomings in research are few, and we tend to believe that at the laboratory level, Soviet agricultural research is probably the equivalent of our own. On the other hand, the Soviets seen less effective in translating research results into practical application.

It appears crucial to me, Mr. Chairman, that at a time when we are addressing the future agricultural needs of the United States in the long term respect, that we not ignore, but rather take note, of the international ramifications that have resulted from the apparent lack of long-range planning on the part of other nations.

Mr. SCHEUER. The Subcommittee on Natural Resources, Agricultural Research and Environment will come to order.

Today, we will be having our second day of hearings on long-term agricultural research needs of our country.

On Tuesday, the subcommittee received testimony from representatives from the Office of the Assistant Secretary for Science

and Technology of the Department of Agriculture. They advised us that the Department of Agriculture has developed long-term nationwide agricultural research goals, and that the Department of Agriculture was currently in the process of examining the order of priorities of these research objectives.

We had a long discussion of that subject, and I think we were concerned with the lack of coordination and absence of sharp focus of that effort.

The witnesses from the Office of Technology Assessment [OTA] and the General Accounting Office [GAO] were highly critical of the agency goals, systems for priority setting, and long-term research planning program.

Representatives from both of these offices testified that the agency did not have long-term research goals that were quantifiable.

Another panel of witnesses from the land-grant colleges and the State experimental stations also expressed serious reservations concerning the USDA program. They testified that the planning and implementation of the long-term research goals should include representation from both of these organizations.

Today we will have testimony from the OSTF [Office of Science and Technology Policy], the National Science Foundation, private industry, and from Resources for the Future. We expect each of these groups to address the capacity of Federal, State, local, and private institutions to establish nationwide agricultural research goals mechanisms necessary to achieve these goals.

We hope that the testimony that will be presented will help clarify the issues surrounding the establishment of our Nation's long-term agricultural research needs.

With that, since we have just had a rollcall vote, why don't we suspend for 12 or 15 minutes, so that when we start the first panel, we can do so uninterrupted. We will suspend for about 12 minutes.

[Recess for members to vote.]

Mr. SCHEUER. The subcommittee will resume. We will now call the first panel: Dr. Denis Prager, Associate Director of Human Resources and Social and Economic Services of the Office of Science and Technology Policy on Executive office agency; Dr. John L. Brooks, Division Director of Environmental Biology, National Science Foundation; and Dr. Emery Castle, president of Resources for the Future.

All of your full written testimony will be printed in full in the record, so what I would suggest to you is that you sum up your testimony in no more than 8 or 10 minutes, and then I am sure we will have some questions for you.

We will start off with Dr. Prager.

STATEMENTS OF DENIS J. PRAGER, ASSISTANT DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY, EXECUTIVE OFFICE OF THE PRESIDENT; JOHN L. BROOKS, DIVISION DIRECTOR, ENVIRONMENTAL BIOLOGY, NATIONAL SCIENCE FOUNDATION, ACCOMPANIED BY H. T. HUANG, PROGRAM MANAGER, ALTERNATE BIOLOGICAL RESOURCES PROGRAM, NATIONAL SCIENCE FOUNDATION; AND EMERY CASTLE, PRESIDENT, RESOURCES FOR THE FUTURE

Mr. PRAGER. Thank you, Mr. Chairman. I am really very pleased to be here and to be able to address from the perspective of the Executive Office of the President the future of agricultural research.

I will summarize and ask that the statement be submitted for the record.

Let me start by placing the discussion of agricultural research policy in the context of the overall science policy of the Reagan administration.

I think it will be useful in these discussions to look at agricultural research in the same way that we look at science and technology across the Government.

It is clear that scientific and technological advances are prerequisites to attainment of national aspirations for a strong, vital economy, enhanced national security and international stature, and improved health and well-being for all Americans. President Reagan's recognition of this fact is demonstrated by the stress on research and development [R&D] in his fiscal year 1983 budget proposal to Congress and by the development by his administration of a science policy designed to increase the likelihood that needed scientific and technological advances are forthcoming.

The administration's science policy is designed to assure that this country's R&D resources, both public and private, are allocated in an optimal fashion. This policy comprises several key elements.

1. Optimum use of all R&D resources, both public and private: This will require careful delineation of the appropriate roles for the public and private sectors in the support and conduct of R&D.

2. The Federal role: Support and conduct of long-term, high-risk fundamental science and targeted basic research; assuring the health of the scientific enterprise on which we depend for new knowledge and future scientists and engineers; support and conduct of applied research and development where necessary to achieve unique Federal missions or where the Federal Government is the sole or primary customer; and, providing an environment within which private sector R&D, innovation, and technology development and commercialization can flourish.

A complement to this is the private sector role. We believe that the private sector's responsibility is simply to support and conduct research and development in support of improved and new commercial products and processes for domestic and international markets.

Let me return to the Federal role and talk about the criteria for Federal support of R&D.

First, the support of research and development should be based on discrimination. By that we mean that the Government should support the most promising and the most productive areas of

science at the expense of those showing the lowest promise. This is clearly most salient in an era of limited resources. The second criterion is excellence. That is, the selection of fundamental science projects should be based solely on the basis of the excellence of the science, the excellence of the scientists, and the excellence of the institutions; and third, selection of targeted basic and applied science projects should be based on excellence plus pertinence to national needs. Lastly, we believe that we should be maximizing research productivity. In an era of constrained resources and tight budgets, we can increase research output by increasing the productivity of the research enterprise. This can be accomplished by (1) reducing to a minimum federally imposed rules, regulations, procedures, and paperwork which now burden research scientists in institutions and reduce research productivity; and, (2) increasing local institutional responsibility for, and control over, decisions concerning allocation of Federal research and development resources.

Within this context, then, let me talk about agricultural research policy.

Nowhere are the benefits to the Nation of research and development more evident than in agriculture. Agriculture, to a degree recognized by few, is vitally important to this country. However, many of us feel that American agriculture is disturbingly fragile now and facing ever-increasing challenges in the future.

The seriousness of the present and future threats to American agriculture indicates the scope and the magnitude of present and future agricultural research needs. And yet many observers of the agricultural research scene question whether the traditional agricultural research enterprise can meet those needs.

I will list some of the concerns and perceptions which are cited by these observers: Declining quality of research and of faculty and graduate students; inadequate attention to long-term basic science; important areas of agricultural research receiving inadequate attention; increasing involvement of research institutions outside of the traditional agricultural research institutions; inadequate cooperation and coordination among these institutions and those traditionally involved in agricultural research; and inadequate Federal scientific leadership in a field of national importance.

The Reagan administration recognizes the role of research in meeting the needs of American agriculture, and is committed to taking the steps necessary to strengthen this country's agricultural research enterprise.

Using the science policy which I described before, let me outline the approach that the administration is developing for agricultural research.

First of all, there is the question of optimum use of research and development resources, both public and private. From the founding of the agricultural research system in the late 1800's to after World War II, the State agricultural experiment stations and the USDA were responsible for most of the research in this country applicable to agriculture. Agriculture research accounted for a large portion of the entire Federal R&D budget. Other research agencies did not exist at that time. Other public and private universities did relatively little biological research, and industry invested relatively little, if any, in agricultural research and development.

In recent years, however, much of this has changed. Now, agriculture research is a small part of the total Federal R&D effort, even a small part of the USDA budget. Other Federal agencies fund major research programs—the National Science Foundation is one. Other State and private universities conduct agriculture-related research and train future biological scientists, and industry supports major basic and applied biological research programs aimed at new agricultural products.

Much of the current concern over the future of agricultural research centers about the long-range impact of these changes on the traditional agricultural research partners and about their ability to adapt to the reality of these changes in institutions and relationships.

Clearly, it is in the national interest that all relevant resources in this country be applied to the development of new knowledge and technologies and their application to the solution of problems facing American agriculture.

Accordingly, the administration is taking steps to: Clarify the appropriate roles of the public and private sectors in the support and conduct of agricultural research; strengthen the relationship between the USDA and the State agricultural experiment stations, concentrating on substantive coordination of scientific activities instead of on budgetary and administrative matters; increase communication and coordination between the USDA and industry; stimulate increased substantive interaction between experiment station scientists and those of other State and private research universities and industry; and increase the use of research project grants to fund high priority basic science by scientists at all research intitutions—public and private—capable of contributing to the national effort in science for agriculture.

Since enactment of the Hatch Act in 1887, the Federal Government has been a key player in the agricultural research arena. During most of its existence, research and education activities were the raison d'etre for the USDA and accounted for most of its budget.

The Federal role was clear and prominent. As a member of the so-called Federal-State partnership, the Federal Government provided funds to experiment stations for research, conducted research in in-house laboratories, and coordinated State and Federal research activities.

Now, however, the Federal role in agricultural research has become less clear, as the USDA has lost its primary focus on research and education. The land-grant institutions question the Federal commitment to the Federal-State partnership, as growth of formula funds to the States has leveled off.

The mission of the USDA labs is diffuse and the quality of their research uneven. Federal scientific and intellectual leadership has largely been abrogated.

An important element of administration agricultural research policy is clarification and implementation of the Federal role in agricultural research. That role includes:

Providing overall scientific leadership to the agricultural research enterprise;

Helping to support, through formula funds matched by State appropriations, the ability of the individual States to conduct research on agricultural problems of special concern to a specific geographical locale, State, or region;

Providing substantive leadership and coordination to facilitate the flow of information among States and between the States and the Federal Government, and to identify opportunities for regional programs and national emphases;

Assuring the development of new, fundamental knowledge on which future advances in agriculture depend, by supporting and conducting major programs in basic agricultural science; and

Maintaining a Federal research capability responsible for conducting research in support of unique Federal missions.

We look to the private sector to support that research and development intended to result in commercial products and processes for the food and agriculture industries. The Federal Government should neither support nor conduct research of this kind.

Federal support of basic science for agriculture must be based solely on two criteria—the promise and productivity of the research area, and the scientific merit of the individual projects within that area. For this reason, the administration intends to continue to emphasize the support of high priority basic science in promising research areas by means of research project grants awarded on a competitive basis.

The administration is reducing to a minimum, Federal oversight, control, and regulation of block grants to the States for all purposes, including research. For this reason, USDA is taking steps gradually to reduce the oversight and administration functions of the Cooperative State Research Service staff in Washington, focusing to the maximum degree on programmatic leadership and coordination. This approach will return the control of formula funds to the States where it belongs, and increase the time and effort devoted to research, rather than Federal paperwork.

Mr. Chairman, in these hearings, you are wisely concentrating on the future—future research needs and the ability of the agricultural research system to meet those needs. I say wisely concentrating on the future, because I believe that much of the current concern over the future of agricultural research is based on the perception that the system is preoccupied with the past, clinging to tradition while fighting change and avoiding adaptation.

Clearly, the ability of American agriculture to prosper in the face of the challenges it faces over the decade of the 1980's and beyond depends upon the creation and application of critical new knowledge and innovative technologies.

This will require exploiting all American scientific and technical expertise relevant to agriculture, no matter in what sector or institution that expertise may reside. The application to agriculture of all relevant science and technology will require change and adaptation among the traditional agricultural research institutions, as well as a willingness among institutions not traditionally considered part of the system to form new kinds of alliances and partnerships.

It is my belief that the future of American agricultural research—and, thus the future of American agriculture—depends

upon just this kind of institutional change. Further, I believe that the requisite change and its constructive consequences will result from substantive intraction of scientists with common research interests and objectives, not from imposition by administrators of planning goals and directions.

In general, I expect little in the way of real substantive progress in advancing science and technology, from formal, centralized planning. It is my contention that the agricultural community expends more time, effort, and travel funds on needs identification, priority setting, and budget and program planning than most other areas of science combined, with precious little to show for it, in terms of real planning and constructive condition.

I look to open, substantive cooperation among scientists with common research interests related to agriculture as the vehicle for mobilizing the resources necessary to meet the challenges of agriculture ahead.

If we are going to have real planning in terms of the future of science, that cooperation and planning must be directed toward meeting the critical needs of American agriculture; acknowledge and involve all scientific disciplines and institutions capable of contributing new knowledge and technologies to the solution of agricultural problems; recognize the appropriate roles and responsibilities of institutions and sectors based solely on their ability to contribute; be open and based on trust; and involve objective critical evaluation of research performance.

Mr. Chairman, I would be pleased to answer any questions.

[The prepared statement of Mr. Prager follows:]

TESTIMONY OF DR. DENIS J. PRAGER
ASSISTANT DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
BEFORE THE
SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH, AND ENVIRONMENT
COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES
JULY 29, 1982

Mr. Chairman and members of the Subcommittee, I am Dr. Denis J. Prager, an Assistant Director of the White House Office of Science and Technology Policy. I am most pleased to have this opportunity to address, from the perspective of the Executive Office of the President, future agricultural research needs and the ability of the agricultural research system to meet those needs.

THE POLICY CONTEXT

Mr. Chairman, I wish to begin this statement by placing my discussion of agricultural research policy in the context of the overall science policy of the Reagan Administration.

Scientific and technological advances are prerequisites to attainment of national aspirations for a strong, vital economy, enhanced national security and international stature, and improved health and well-being for all Americans. President Reagan's recognition of this fact is demonstrated by the stress on research and development (R&D) in his FY 83 budget proposal to Congress and by the

development by his Administration of a science policy designed to increase the likelihood that needed scientific and technological advances are forthcoming.

The FY 83 President's budget to Congress includes real growth for R&D and for basic research. That R&D should receive the second largest increase of any budget function, during a time of severe fiscal constraint, is highly significant and indicative of the importance this Administration attaches to strengthening the scientific and technological foundation for the future well-being of our country and its citizens.

The Administration's science policy is designed to assure that this country's R&D resources are allocated in such a way as to facilitate and stimulate the development of new knowledge and technologies and their application to solving important national problems and to meeting domestic and international needs for new products and processes. This policy comprises several key principles:

1. Optimum use of all R&D resources, both public and private:

   - careful elucidation of the appropriate roles

for the public and private sectors in the support and conduct of R&D.

2. The federal role:

- support and conduct of long-term, high-risk fundamental science and targeted basic research

- assuring the health of the scientific enterprise on which we depend for the development of new knowledge and future scientists and engineers

- support and conduct of applied research and development only where necessary to achieve unique federal missions or where the Federal Government is the customer

- providing an environment within which private sector R&D, innovation, and technology development and commercialization can flourish.

3. The private sector role:

- support and conduct of R&D in pursuit of improved and new commercial products and processes for domestic and international markets.

4. Criteria for federal support of R&D:

- o discrimination: support of the most promising and productive areas of science at the expense of those showing the least promise

- o excellence: selection of fundamental science projects solely on the basis of the excellence of the science, the scientists, and their institutions

- o pertinence: selection of targeted basic science projects on the basis of excellence plus pertinence to national needs.

5. Maximizing research productivity:

- o reducing, to a minimum, federally-imposed rules, regulations, procedures, and paperwork which burden research scientists and institutions and reduce research productivity

- o increasing local institutional responsibility for, and control over, decisions concerning the allocations of federal resources for R&D

AGRICULTURAL RESEARCH POLICY

Mr. Chairman, nowhere are the benefits to the Nation of research and development more evident than in agriculture.

Agriculture, to a degree recognized by few, is vitally important to our national security, the strength of our economy, and the health and welfare of our citizens. However, American agriculture is disturbingly fragile: those remaining in farming operate on an increasingly thin margin, stressing their land and financial solvency and pushing our collective knowledge and technologies to the limit. This fragile enterprise faces even greater challenges as the demand for food increases worldwide, domestic and international markets compete, and commodity and food sales return proportionately less to producers while the inputs to agriculture -- land, water, energy, chemicals, labor, and capital -- become more costly and less available.

The seriousness of these threats to the future of American agriculture indicates the scope and magnitude of the challenges facing the research enterprise on which agriculture depends for the scientific and technological advances it requires to survive and flourish. Yet, many observers of

the agricultural research scene question whether the traditional agricultural research enterprise -- comprising primarily the State Agricultural Experiment Stations (SAES) and the USDA -- is up to meeting the scientific and technological challenges it faces in the decades ahead.

Generally, those concerned with the health of the agricultural research enterprise site evidence for, and perceptions of:

- declining quality of research;
- declining quality of faculty and graduate students;
- too little attention to long-term basic science;
- important areas of agricultural research receiving inadequate attention;
- the prominence of other research institutions in cutting-edge biological research;
- increasing isolation of agricultural scientists from the mainstream of life sciences;

11-864 O - 83 - 17

- o inadequate cooperation and coordination among the various institutions involved in agricultural research; and

- o inadequate federal scientific leadership in a field of national importance.

Mr. Chairman, the Reagan Administration recognizes the critical role of research in meeting the increasingly difficult challenges facing American agriculture, and is committed to taking the steps necessary to strengthen this country's agricultural research enterprise. Secretary Block and Deputy Secretary Lyng have stated many times their commitment to research and identified research as their highest priority in the FY 83 budget process. This commitment is mirrored at the White House level.

Using the Reagan Administration science policy as a framework, let me outline the approach the Administration is taking to strengthening the agricultural research system.

1. Optimum use of all R&D resources, both public and private:

Since the founding of the "agricultural research system"

in the late 1800s, the State Agricultural Experiment Stations (SAES) have been the principal non-federal performers of agricultural research. The Hatch Act of 1887 established a unique relationship between these stations and the USDA with funds going to the SAES on the basis of a formula, with state matching, and USDA coordinating federal and state research. During most of the existence of the "system", this relationship (the "partnership") was responsible for most of the research in this country applicable to agriculture: agricultural research accounted for a large portion of the entire federal R&D budget; other research agencies (NIH, NSF, etc.) didn't exist; other public and private universities did relatively little biological research; and industry invested relatively little, if any, in agricultural R&D.

However, in recent years, all this has changed. Agricultural research has become a small part of the total federal R&D effort, even a small part of the USDA budget. Other federal agencies (NIH, NSF, DOE, DOD) fund major research programs of significance to agriculture. Other state and private universities receive funding from these agencies for agriculture-related research and for training of future biological

scientists. And, industry is rapidly increasing its support of basic and applied biological research as the potential applications of biotechnology become apparent.

Much of the current concern over the future of agricultural research centers about the long-range impact of these changes on the institutions to which we look for the development of new knowledge and its application to agriculture, and about the ability of the traditional partners -- USDA and the SAES -- to adapt to the reality of these changes in institutions and relationships.

Clearly, it is in the national interest to assure that all relevant research and development resources in this country are applied to the development of new knowledge and technologies and their application to the solution of problems facing American agriculture. Accordingly, the Administration is taking steps to:

- clarify the appropriate roles of the public and private sectors in the support and conduct of agricultural research;

- strengthen the relationship between the USDA and the State Agricultural Experiment Stations concentrating on substantive coordination of scientific activities between SAES and USDA scientists, instead of the current preoccupation with budgetary and administrative matters;

- increase communication and coordination between the USDA and industry;

- identify mechanisms for stimulating the increased substantive interaction among SAES scientists and those of other state and private research universities and industry on scientific matters of common interest related to agriculture; and

- increase the use of research project grants to fund high priority basic science by scientists at all research institutions -- public and private -- capable of contributing to the national effort in science for agriculture.

2. The federal role:

Since enactment of the Hatch Act in 1887, the Federal Government, acting through the USDA, has been a key player in the agricultural research arena, providing funds to experiment stations for research, conducting research in in-house laboratories, and coordinating state and federal research activities.

During most of its existence, research and education activities were the raison d'etre for the USDA and accounted for most of its budget. The federal role was clear and prominent. As a member of the so-called "federal-state partnership," the Federal Government was viewed as an integral part of the powerful coalition which, for many years, set research priorities, influenced the size of budgets and the allocation of resources, and nurtured and protected the USDA and the land-grant institutions via the political process. Through its substantial and politically attractive network of research laboratories and field sites, many co-located with state facilities, the USDA performed most of the basic science related to agriculture, set the standards for research quality

and excellence in the field, and provided the scientific and intellectual leadership, both domestically and internationally, for agricultural research.

Now, however, much of this has changed. The research-education coalition, which once dominated the agriculture scene, has largely been replaced by a large number of special interest groups representing commodity, consumer, agribusiness, and specialized farm interests with little or no concern for research issues. The "farm bloc" which once controlled Congress has largely disappeared as the country has become urbanized. And, the USDA has long since lost its primary focus on research and education, as its political attention has been diverted to providing direct economic benefits to a specific set of farmer and business interests.

As a result of these changes, the federal role in agricultural research has become less clear. The land-grant institutions question the federal commitment to the federal-state partnership, as growth of formula funds to the states has levelled off. The mission of the USDA labs is diffuse and the quality of their research uneven. The federal role in providing scientific and intellectual leadership has largely been abrogated.

An important element of Administration agricultural research policy is clarification and implementation of the federal role in agricultural research. That role includes:

- providing overall scientific leadership to the agricultural research enterprise in the identification of research needs, the setting of research priorities, and in developing plans and programs to address those needs and priorities;

- helping to support, through formula funds matched by state appropriations, the ability of the individual states to conduct research on agricultural problems of special concern to a specific geographical locale, state, or region;

- providing substantive leadership and coordination to facilitate the flow of information among states and between the states and the Federal Government and to identify opportunities for regional programs and national emphases;

- o assuring the development of new, fundamental knowledge on which future advances in agriculture depend, by supporting and conducting major programs in basic agricultural science; and

- o maintaining a federal research capability responsible for conducting research in support of unique federal missions.

3. The private sector role:

We look to the private sector to support that research and development intended to result in commercial products and processes for the food and agriculture industries. The Federal Government should neither support nor conduct research of this kind, focusing instead on fundamental science, targeted basic research, and applied research related to unique federal missions.

4. Criteria for federal support of R&D:

Federal support of basic science for agriculture must be based solely on two criteria -- the promise and

productivity of the research area, and the scientific merit of the individual projects within that area. For this reason, the Administration intends to continue to emphasize the support of high priority basic science in promising research areas by means of research project grants awarded on a competitive basis.

5. Maximizing research productivity:

It is the policy of this Administration to reduce to a minimum, federal oversight, control, and regulation of block grants to the states for all purposes, including research. For this reason, USDA is taking steps gradually to reduce the oversight and administration functions of the Cooperative State Research Service staff in Washington, focusing to the maximum degree on programmatic leadership and coordination. The approach will reduce the size and cost of the federal CSRS staff, return the control of formula funds to the states where it belongs, and increase the time and effort devoted to research, rather than federal paperwork.

PLANNING

Mr. Chairman, in these hearings, you are wisely concentrating on the future -- future research needs and the ability of the agricultural research system to meet those needs. I say wisely concentrating on the future, because I believe that much of the current concern over the future of agricultural research is based on the perception that the system is preoccupied with the past, clinging to tradition while fighting change and avoiding adaptation.

Clearly, the ability of American agriculture to prosper in the face of the challenges it faces over the decade of the 80s and beyond depends upon the creation and application of critical new knowledge and innovative technologies. The creation of knowledge and technologies equal to the myriad and complex challenges they are to meet, will require exploiting all American scientific and technical expertise relevant to agriculture, no matter in what sector or institution that expertise may reside. The application to agriculture of all relevant science and technology will require change and adaptation among the traditional agricultural research institutions, as well

as a willingness among institutions not traditionally considered part of the "system" to form new kinds of alliances and partnerships.

It is my belief that the future of American agricultural research -- and, thus the future of American agriculture -- depends upon just this kind of institutional change. Further, I believe that the requisite change and its constructive consequences will result from substantive interaction of scientists with common research interests and objectives, not from imposition by administrators of planning goals and directions.

In general, I expect little in the way of real substantive progress in advancing science and technology from formal, centralized planning. It is my contention that the agricultural community expends more time, effort, and travel funds on needs identification, priority setting, and budget and program planning than most other areas of science combined, with precious little to show for it. The frustrations of the Joint Council on Food and Agricultural Sciences are but one example. I look to open, substantive cooperation among scientists with common research interests related to agriculture as the vehicle for mobilizing the resources

necessary to meet the challenges of agriculture ahead. In order for such substantive cooperation to be successful, it must:

- be directed toward meeting the critical needs of American agriculture;
- acknowledge and involve all scientific disciplines and institutions capable of contributing new knowledge and technologies to the solution of agricultural problems;
- recognize appropriate roles and responsibilities of institutions and sectors based solely on ability to contribute rather than on criteria related to turf or tradition;
- be open and based on trust; and
- involve objective, critical evaluation of research performance.

Mr. Chairman, that concludes my formal statement. I will, of course, be pleased to answer any questions you or the other members of the Subcommittee may have.

Mr. SCHEUER. We will get into questions when the other two members of the panel have completed their testimony.

I do want to thank you for an outstanding statement that included many characteristics I was hoping to hear today.

I take it we can perceive of you as an administration spokesman?

Mr. PRAGER. Yes.

Mr. SCHEUER. It was a terrific statement.

We will have some questions for you in just a few minutes.

All right, we will hear from Dr. Brooks, of the NSF.

Your statement will be printed at this point in the record, so if you would take 8 or 10 minutes to summarize your testimony, that would be fine.

Mr. BROOKS. I represent Eloise Clark, Assistant Director, Biological, Behavioral, and Social Sciences, who very much regrets not being able to be before you today.

Mr. SCHEUER. We are very happy to have you here.

Mr. BROOKS. I am accompanied by Dr. Huang, sitting behind me, who is Program Manager of the Alternate Biological Resources Program.

Mr. SCHEUER. He may come up to the table, if you wish.

Mr. BROOKS. Thank you.

I will now proceed to a shorter version of the written testimony, which concerns the role and capacity of the National Science Foundation in supporting research which is necessary to deal with long-term agricultural production problems.

To address the topic, I will first review the purpose and mode of operation of NSF, illustrating how it draws upon the large national resource of available scientific talent in the United States.

I will next review a few examples of NSF-supported findings, past and current, that bear on agricultural productivity.

I will then identify a few agricultural production issues, and types of research that might contribute to resolving them.

I will conclude with a discussion of NSF's role relative to establishing national research goals.

As you know, the NSF is unique among Federal agencies because it is charged with overseeing the health of science across the entire spectrum of scientific disciplines. NSF does not conduct research, but rather accomplishes its mission primarily through support provided to scientists at academic institutions.

The Foundation receives unsolicited proposals from scientists affiliated with colleges, universities, and other nonprofit organizations. NSF research directorates receive more than 18,000 proposals per year; Biological and Behavioral Sciences—the component most closely related to agricultural research—accounts for 33 percent, or 6,000 proposals, of this total.

A proposal is a complex instrument setting forth a reasoned justification and technical documentation for pursuit of a particular line of research. Proposals are evaluated in competitive peer review involving scientists nationwide, who are selected by NSF staff as the most appropriate reviewers of each proposal. The primary criteria for selecting proposals for award are scientific merit and potential contribution to scientific knowledge. Because NSF is asked to consider supporting the "cutting edge" of fundamental,

non-targeted research, it does, in fact, support work that proves to be highly relevant to national problems.

Solutions to long-term scientific problems require an ever-growing body of knowledge, and a pool of committed, bright and active scientists. Historically, NSF has established working relationships with talented scientists at colleges and universities and has committed itself to scientific excellence.

To give you some measure of the significance of the role of the NSF, in fiscal year 1981, NSF invested about $34 million of the total expenditure—about $100 million—by Federal agencies for competitive research in the plant sciences. This funding supported some 600 projects throughout the United States. In other areas of biology, including systematic biology, population biology and physiological ecology, ecology, and ecosystem studies—many of which are relevant to agriculture—NSF provides 95 percent, about, of the support available for investigator-initiated basic research at colleges and universities

To turn to my second point—recent NSF support activities that illustrate NSF's responsiveness to long-term issues—I will use two examples, both involving the biology of crop plants.

Plants are the ultimate resource upon which all forms of animal life depend for food. Yet we understand less about the fundamental biology of plants than about animals and certain microorganisms.

Attempts to increase agricultural productivity by conventional means may have reached a point of diminishing returns, because of increasing demands for water and fertilizer, and the continuing loss of usable land through urbanization and soil erosion.

This suggests that the goals for food production for the year 2000 must be reached by alternative approaches: Increasing the innate productivity of crops, decreasing losses sustained in the field and after harvest, and reducing dependence on expensive fossil fuels by reducing the requirements for nitrogen fertilizer and synthetic pesticides. Two areas of basic research provide new approaches to the problem of increasing crop productivity and decreasing field losses—plant biotechnology and integrated pest management.

The first example, plant biotechnology, is the result of fundamental research on the structure and function of genes, and how they are expressed in the cellular environment. The application of this technology to plants may prove to be a major factor in achieving the food production goals projected for the year 2000.

Such an outcome may be possible because of another fortunate property of plants—in general, plant cells are totipotent. That is to say, any cell taken from a plant and placed under proper conditions can reconstitute a whole plant. Of course, that is not true for animals.

This means that if one could introduce a particular gene into a plant cell, by recombinant DNA technology or other means, one could regenerate a new plant with desired genetic traits. Theoretically, by proper genetic manipulation, new crop plants can be constructed with all kinds of desirable properties. For example, plants with the ability to fix nitrogen, so that they can be grown without nitrogen fertilizer.

At the current state of our knowledge, many obstacles remain to be overcome before such potential can be realized. Yet the possibili-

ties have captured the imagination of scientists, entrepreneurs, farmers, and financial managers. Full realization of the potential requires continued investment in basic research on scientific questions of a high-risk, long-term nature. I will highlight some of these remaining problems in my remarks about NSF's capabilities as they apply to the future.

The second example is research on the ecological balance in agricultural crop systems, especially research underlying integrated pest management—IPM. In the past, biologists and agricultural scientists attempted to control pests in two ways: biologically and chemically.

Biological control includes the selection of genetic varieties of crops resistant to pests and the introduction of pathogens, parasites, and predators which, while not harming the crops, would reduce the pest populations.

Chemical pest control involves the application of organic or inorganic toxicants. Integrated pest management, the newer approach, attempts to use the best features of both chemical and biological pest control in order to control optimally the particular pest or suite of pests afflicting a certain crop.

Since the successful application of IPM involves farmers, other agencies, many crops and substantial research, extensive cooperation will be essential over the long term. NSF's role in the future of IPM will be to continue an innovative and effective program of support for basic scientific research in the biological sciences. Most of this IPM research to date has been done in conjunction with personnel from State experiment stations and the Agricultural Extension Service.

Indeed, the further development of agroecology, generally carried out in cooperation with USDA scientists, establishes a vehicle for rapid transfer of basic research findings to practical use.

I will now address NSF's role in the future. The basic research of today constitutes a critical investment toward solutions of long-term problems. I need not dwell on the complex of factors that influence agricultural production—they include biology, ecology, technology, socio-economic variables, and national and international policies. At the risk of oversimplification, let me touch on but one issue, to illustrate NSF's view of an aspect of how the research it supports may contribute to the world's agricultural future.

In addition to plant biotechnology and integrated pest management, which I already mentioned, one of the important areas is called biological diversity.

We need to investigate more fully the Earth's biological diversity. To develop the potential of biotechnology, we will need a broader array of genetic material than is now represented by the relatively small number of varieties of commonly cultivated species now used by U.S. growers.

Natural communities from all parts of the world, but especially the tropics, need to be examined systematically for as yet unknown wild varieties. Furthermore, we must also search for wild species related to cultivated species. They may have genetic traits useful in engineering new crops. They may also have potential for agricultural use on land, such as desert, now considered marginal or unusable.

At the present time, in fact, NSF is supporting research on the possible use of underutilized plant species that will grow under arid conditions. This research is on a number of plants native to the arid Southwest—such as quayule and jojoba, which produce unusual energy-rich hydrocarbons. Guayule is now being developed as a potential domestic source of natural rubber, and jojoba as a substitute sperm whale oil.

I heard the egg timer. May I have another minute or two?

Mr. SCHEUER. Please proceed.

Mr. BROOKS. I want to address now the NSF and the national research goals.

As applicable to agricultural production problems of the future, NSF has a key role in support of basic research on the plant sciences and ecosystem studies. To the extent that present agricultural productivity is built upon past scientific achievements, diminishing natural resources and increasing food needs necessitate a new approach for the future.

The approach should exploit the recent advances in genetic and molecular biology, our improved understanding of the nature of ecosystems, and current and future studies of biological diversity.

The explosive ferment in "plant biotechnology" has accentuated two problems that have plagued the plant science community for some time. The first is the limited number of plant scientists, particularly those with expertise at the tissue, cellular and molecular level.

The second problem is that the state of knowledge about plants, particularly in cellular biology and molecular genetics, lags behind that achieved in corresponding areas in the animal and microbial sciences.

In fiscal 1983, NSF, within current resources, will increase its contribution in these areas through special efforts for young scientists, augmented funding for meritorious proposals in plant molecular biology, and for special emphases in other key research areas.

In conclusion, may I return to an earlier point—solutions to problems require knowledge, and the scientific talent to develop and implement solutions. Projections of need and availability of resources are made on the basis of extant knowledge and educated guesses about likely advances. Projections are imperfect. For example, the projections of food—production increases by the year 2000 were based on likely advances in fertilizers and other chemicals—not the advances in plant biotechnology.

Mr. SCHEUER. Did you leave out the adjective "exciting" on purpose?

Mr. BROOKS. Pardon me. Let me read that sentence again.

For example, the projections of food production increases by the year 2000 were based on likely advances in fertilizers and other chemicals—not the exciting advances in plant biotechnology.

Mr. SCHEUER. I am excited about what you are telling us.

Mr. BROOKS. It is a rosy possibility. Unforeseen advances promote realization of goals, but, on the other hand, problems—technical or otherwise—delay realization of goals.

Basic research contributes to the knowledge base necessary to resolve problems. Setting national research goals for agricultural productivity and the fundamental knowledge that underpins future

11-864 O - 83 - 18

agricultural practices and innovations requires continuing appraisal.

Collaboration and effective communication of the knowledge base developed by scientists across the country through support from NSF, USDA, and other agencies with related research missions are key aspects of this enterprise.

NSF's most effective role will be to continue to support research that identifies and pursues the most promising avenues of advancing knowledge.

[The prepared statement of Mr. Brooks follows:]

STATEMENT OF
DR. JOHN L. BROOKS
DIVISION DIRECTOR, ENVIRONMENTAL BIOLOGY
DIRECTORATE FOR BIOLOGICAL, BEHAVIORAL, AND SOCIAL SCIENCES
NATIONAL SCIENCE FOUNDATION
BEFORE THE
SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT
OF THE
COMMITTEE ON SCIENCE AND TECHNOLOGY
U. S. HOUSE OF REPRESENTATIVES
JULY 29, 1982

Mr. Chairman and Members of the Subcommittee,

I am pleased to discuss with you the role and capacity of the National Science Foundation (NSF) to support research necessary to deal with long-term agricultural production problems. To address the topic, I will first review the purpose and mode of operation of NSF to illustrate how it draws upon the large national resource of available scientific talent in the U.S. I will next review a few examples of NSF-supported past and current findings that bear on agricultural productivity. I will then identify a few agricultural production issues and types of research that might contribute to resolving them. I will conclude with a discussion of NSF's role relative to establishing national research goals.

As you know, the NSF is unique among Federal agencies because it is charged with overseeing the health of science across the entire spectrum of scientific disciplines. NSF does not conduct research, but instead accomplishes its mission through award of support on a competitive basis. The Foundation receives unsolicited proposals, primarily from scientists affiliated with colleges, universities, and other non-profit organizations. NSF research directorates receive more than 18,000 proposals per year; Biological and

Behavioral Sciences--the component most closely related to agricultural research--accounts for 33% or 6,000 proposals of this total.

A proposal is a complex instrument setting forth a reasoned justification and technical documentation to pursue a particular line of research. NSF thus sees the "best" scientific research ideas that scientists offer, obtaining a view of current scientific thinking, unfettered by, but not in ignorance of, the needs of the present. Proposals are evaluated by a competitive peer review process involving scientists from all over the country. The primary criteria for selecting proposals for awards are scientific merit and potential contribution to scientific knowledge. Because NSF deals with the cutting edge of research in supporting fundamental, non-targeted research, it does in fact support work that proves to be highly relevant to national problems.

Solutions to long-term scientific problems require an ever-growing body of knowledge and a pool of committed, bright and active scientists. Historically, NSF has established working relationships with talented scientists at colleges and universities and has committed itself to scientific excellence. For example in FY 1981, NSF invested about $34 million of the total expenditure (about $100 million) by Federal agencies for competitive basic research in the plant sciences. The funding supported some 600 projects throughout the U.S. In other areas of biology, including systematic biology, population biology and physiological ecology, ecology, and ecosystem studies--much of which are relevant to agriculture--NSF provides 95% of the support available for investigator-initiated basic research at colleges and universities.

NSF CONTRIBUTIONS

To turn to my second point--recent activities and trends illustrative of NSF's responsiveness to long-term issues--I will use two examples, plant biotechnology and integrated pest management.

Plant Biotechnology

Plants are the ultimate resource upon which all forms of animal life depend for food. Yet we understand less about the fundamental biology of plants than about animals and certain microorganisms. Since the early 1970s, NSF staff and advisory committees have held meetings with scientists from the academic community and with counterpart staff from USDA and DOE. A continuing series of workshops and conferences attempts to identify especially promising research opportunities and special needs.

Studies since the mid-1970s have included the international conference on "Crop Productivity - Research Imperatives" of 1976, a panel report on "Researchable Areas Which Have Potential for Increasing Crop Production" of 1976, the NRC/NAS "World Food and Nutrition Study - The Potential Contributions of Research" of 1977, a publication of the Congressional Office of Technology Assessment, "Organizing and Financing Basic Research to Increase Food Production" also of 1977. In addition, numerous private and international agencies sponsored conferences on the same theme. A surprising unanimity emerged from these efforts and reports.

During the ensuing years, NSF has maintained contact with USDA to discuss scientific initiatives, to avoid duplicative efforts, and to ensure that the most promising research is supported. This contact occurs at several levels: between project officers on individual proposals; at the program level; and at the policy level. The Interagency Discussion Group on Basic Research in the Plant Sciences has met approximately monthly under the leadership of an NSF staff member since the fall of 1977. In addition to NSF and USDA, the group includes program officers from other Federal agencies (DOE, NIH) that provide support for plant sciences research. In 1979, it published a summary of all Federal activities in the support of plant research; an updated summary is due in 1982.

Attempts to increase agricultural productivity by conventional means may have reached a point of diminishing returns because of increasing demands for water and fertilizer and continuing loss of usable land through urbanization and soil erosion. This suggests that the goals for food production for the year 2000 must be reached by alternative approaches: increasing the innate productivity of crops, decreasing losses sustained in the field and after harvest, and reducing dependence on expensive fossil fuels by cutting down the requirements for nitrogen fertilizer and synthetic pesticides. Two areas of basic research that provide new appproaches to the problem of increasing crop productivity and decreasing field losses--plant biotechnology and integrated pest management--meet this requirement. Both can be applied without increasing the consumption of fossil fuels.

The first example, plant biotechnology, is the result of fundamental research on the structure and function of genes and how they are expressed in the cellular

environment, culminating in the development of recombinant DNA technology. The application of this new knowledge has led to the establishment of a multi-million dollar biotechnology industry that promises to deliver products such as insulin, interferon, growth hormones, and vaccines in abundant quantities.

In turn, the application of this technology to plants may prove to be a major factor in achieving the food production goals projected for the year 2000. Such an outcome is possible because of another fortunate property of plants--in general, plant cells are totipotent. That is to say, any cell taken from a plant and placed under proper environmental conditions will develop into a complete plant. This means that if one could introduce a particular gene into a plant cell, by recombinant DNA technology or other means, one could regenerate a new plant with desired genetic traits. Theoretically, by proper genetic manipulation, new crop plants can be constructed with all kinds of desirable properties. For example, plants with greatly enhanced photosynthetic efficiency that mature quickly; plants with the ability to fix nitrogen, so that they can be grown without the use of nitrogen fertilizer; and plants with innate resistance to disease and pests, so that they will be less dependent on chemical pesticides.

At the current state of our knowledge, many obstacles remain to be overcome before such potential can be realized. Yet the possibilities are breathtaking, and the new plant biotechnology has captured the imagination of scientists, entrepreneurs, farmers, and financiers. Time magazine in October 1981 predicted a "$50 billion to $100 billion annual market for agribusiness applications of genetic engineering by 1996--ten times the potential of medical-pharmaceutical applications." Both traditional chemical companies (e.g., Allied Chemicals,

American Cyanamid, Eli Lilly and Monsanto) and the new venture capital companies (e.g., Cetus, Genentech, Biogen SA, International Plant Research Institute) have invested heavily in plant biotechnology. Indeed, we may say that a new scientific industry, plant biotechnology, is taking form. That this development is occurring is a direct consequence of the nation's past investment in basic research. Full realization of its potential requires continued investment in basic research on scientific questions of a high-risk, long-term nature. I will highlight some of these remaining problems in my remarks about NSF's capabilities as they apply to the future.

Integrated Pest Management

The second example is research on the ecological balance in agricultural crop systems, especially in Integrated Pest Management (IPM). Biologists and agricultural scientists have attempted to control pests in two ways: biologically and chemically. Biological control includes the selection of genetic varieties of crops resistant to pests and the introduction of pathogens, parasites and predators which, while not harming the crops, reduce the pest populations. Chemical pest control involves the topical or systematic application of organic or inorganic toxicants. Integrated pest management attempts to use the best features of both chemical and biological pest control in order to control optimally the particular pest or pests afflicting a certain crop. The new developments in biotechnology offer promising opportunities in these efforts.

IPM seems to be a simple, straightforward, almost common sense approach to pest control; in fact, it has become practical only recently. Ecological problems

rarely lend themselves to simple solutions. The number of variables is so large that many years of research and experience were required to bring integrated management techniques to practical use. Not least among the problems was the acceptance of certain fundamental concepts from basic ecological science: (1) that crop stands are, in fact, ecosystems with all of the general components and functions of natural ecosystems; (2) that the individual subunits of a crop ecosystem (fields, orchards, pastures, etc.) are parts of a regional mosaic in which there are numerous connections among the parts; (3) that ecosystem models must be developed and aided by modern computer techniques, made applicable to a given agro-ecosystem.

IPM is an interdisciplinary scientific approach to the problem of pest control. It combines biological and chemical controls with mathematical modeling and computer technology in order to obtain an effective, ecologically-sound, cost-efficient method of reducing crop damage. An effective IPM research program must necessarily involve most, if not all, of the subdisciplines of the biological sciences, along with elements of the physical and social sciences and engineering. Knowledge arising from the many activities of the biological sciences provide a base for IPM research that ultimately can be incorporated into management schemes. It includes:

-- Molecular biology and physiology for understanding the actions of insect hormones and pheromones and of chemical pesticides;

-- Genetics, biochemistry and developmental biology that underlie the creation of resistant crop varieties and the identification of particularly vulnerable periods in pest life cycles;

-- Ethology and behavioral science for insights on how some pests search for hosts and choose host species;

-- Systematic biology and ecology that establish taxonomies, evolutionary trends, and effects of environmental variables; and

-- Ecosystem science to provide the integrative and analytical framework for reducing the crop-pest-environment complex to a tractable problem.

Since the successful application of IPM involves farmers, other agencies, many crops and substantial research, extensive cooperation will be essential over the long term. NSF's role in the future of IPM will be to continue an innovative and effective program of support for basic scientific research in the biological sciences.

NSF AND THE FUTURE

The basic research of today constitutes a critical investment toward solutions of long-term problems. I need not dwell on the complex of factors that influence agricultural production--they include biology, ecology, technology, socio-economic variables, and national and international politics. At the risk of oversimplification, let me touch on a few general issues to illustrate NSF's view of some aspects of how the research it supports may contribute to the world's agricultural future.

Plant Science

I have already indicated some of the possibilities for the application of plant biotechnology to enhance the productivity of crop plants. Before these can be realized, a great number of gaps in our knowledge base need to be bridged. For example, the genetics of higher plants are imperfectly understood. Also, vectors suitable for delivering foreign genes, analogous to plasmids and viruses, remain to be developed. The following key research areas need dramatic advancement.

Molecular Genetics: genome organization; gene identification, isolation and expression; development of vector systems to transport genes into plant cells.

Biochemistry: most metabolic pathways in plants still remain to be elucidated (e.g., little is known about the distribution of the products of photosynthesis).

Early Development: regeneration of plants and embryogenesis in cell culture. Embryo and seed development in plants is poorly understood.

Plant Pathology: still largely empirical and diagnostic with little understanding of the nature of disease.

Biological Diversity

Assuming genetically engineered crop species or new crop species can be obtained to meet special growing condition needs, we are in a race to catalog and understand the biological diversity of nature before the force of population numbers and pressure to develop the natural biosphere leads to its loss. Biological diversity involves genetic diversity (the genetic variability within a species) and ecological diversity (the variety of species in a particular biogeographic area). This biological diversity constitutes the "raw material" from which particular genes or heretofore underutilized food crop or other potentially useful species will be found.

Much remains to be known about the biological diversity of the tropics. NSF provides about 50-55% of the total Federal support in tropical biology research. This represents over 90% of the support for such basic research by scientists at colleges and universities. Topics span broad substantive areas--systematic biology, ecology, physiology and ecosystem studies. In addition, NSF provides substantial support for germplasm and living organism stock centers that are available to the research community. We expect to maintain these resources, along with a strong research program in tropical biology.

Biogeochemistry

Another issue involves the effects of intensive agriculture on the land resource. As a consequence, soil management to control loss of nutrients will be of utmost importance. One general finding from basic research on ecosystems is that they uniformly exhibit a high degree of conservation with respect to

essential nutrients, such as nitrogen and phosphorus, and mineral soil. Knowledge about biogeochemical cycling comes from research supported in substantial part by NSF. Current research seeks to understand the complex processes by which biota, interacting with the soils and sediments, use and recycle essential nutrients. Given the importance of agricultural systems and their often excessive loss of soil and nutrients, scientists are attempting to understand the mechanisms that promote excess loss and whether mechanisms that foster element conservation in natural ecosystems are operative in modified agricultural systems (e.g., conservation tillage, intercropping). The further development of agroecology carried out in cooperation with USDA scientists establishes a vehicle for rapid transfer of basic research findings to practical use.

Alternative Crops

Given a constant and fragile land base, another option to increase agricultural productivity is the development of crop cultivars suitable for less than "ideal" growing conditions. NSF has supported research on a number of plants native to the arid Southwest--such as guayule and jojoba which produce unusual energy-rich hydrocarbons. Guayule is now being developed as a potential domestic source of natural rubber, and jojoba as a substitute sperm whale oil. The buffalo gourd is being investigated as a source of edible oil, protein and starch.

Inadvertent Effects

We--like no other species--have the ability to influence our environment far beyond spheres normally accorded any other animal. In support of an ever

increasing number of people and continued development and advancement of our societies, humankind risks inevitable conflicts between life as we now experience it and the continuing stability of the biosphere.

For example, our increasing use of fossil fuels poses the risk of increasing atmospheric carbon dioxide (CO_2). A continued increase of CO_2 constitutes an "uncontrolled experiment." Atmospheric physics theory would predict a global warming of the earth's surface and consequent shifts, perhaps subtle, in biogeographic zones as we currently know them. Furthermore, we do not know how plants in the natural environment will respond to increased CO_2 levels. Since CO_2 limits photosynthesis--the process by which green plants synthesize carbohydrates--elevated CO_2 could act as a beneficial fertilizer. The point is we simply do not know enough to forecast.

Because of its intrinsic scientific interest as well as relevance to the future, plant scientists are conducting carefully controlled experiments to understand how higher plants will respond to elevated CO_2, particularly as influenced by biotic competition and other limiting variables such as water and essential nutrients. That such research is possible is the result of NSF's investment, some 14 years ago, in phytotron facilities that can provide controlled experimental conditions. Twin facilities were built by NSF. One, at North Carolina State University, is now totally supported by and dedicated to USDA research. The sister facility at Duke University continues to be primarily supported by NSF; other agencies such as DOE and private industry provide support for some experiments.

Recent advances in our ability to formulate mathematical models of forest development and succession in response to climate and classical data from paleoecology provide powerful analytical tools with which to reconstruct past climatic variation and consequent shifts in biospheric zonation. These results provide a clue as to how future climatic change might alter biospheric boundaries. Such research as this requires input from climatologists, such as supported by NSF's Division of Atmospheric Sciences.

Pest Control

Despite advances in chemical and biological pest control and IPM, pre-harvest crop losses due to pests continue to consume useful products. Improved pest management could, in fact, relieve pressure to increase unit area yields. NSF continues to support innovative research on pests and plant-insect interactions. Two lines of research, insect pheromones and natural defense mechanisms, hold promise for the future. Pheromones are chemicals secreted by an insect that affect the behavior of other insects of the same species. They are often the means by which insects communicate with each other. For example, the sex pheromones are vital in enabling males to locate and identify females of the same species. Manipulation of pheromones offers a safe and effective way of controlling the population of insect pests. Usually pheromones occur in minute amounts in insects and their chemical structures are such that they are difficult to synthesize. Recently, in a study of the chemical reactions induced by lasers, a compound was formed which mimics the pheromone used by pine beetles to communicate with each other. The pine beetles annually destroy about one billion dollars worth of timber. With the pheromone mimic readily available, it could be used to disrupt the normal reproductive cycle of beetles.

The second area of promise is the natural defense mechanisms of plants. Land animals depend on the green plants of forest and field for energy. Except for occasional epidemics, the myriad plant-eaters, or herbivores, seldom appear to diminish the completeness of the green cover of the earth's watered regions. A principal deterrent to excessive herbivore damage is the array of toxic compounds elaborated by the green plants themselves. While the particular chemical strategy evolved varies from group to group, all appear successful, because almost every kind of plant is fed upon by only a few insect families that have evolved special countermeasures to the plant's natural toxicity.

Recent studies reveal still another step in this never-ending duel between plants and insects. One project has been studying these interactions in the New Hampshire hardwood forests. Results indicate that individual leaves of any single sugar maple tree differ not only in their content of basic nutrients but also of their toxins. It appears that this variability is advantageous to the tree because the defoliating caterpillars are forced to sample many leaves to obtain adequate food to complete growth. As the caterpiller moves from leaf to leaf it is exposed to bird predation, sparing the tree from extensive damage.

NSF and National Research Goals

As applicable to agricultural production problems of the future, NSF has a key role in support of basic research on the plant sciences and ecosystem studies. To the extent that present agricultural productivity is built upon past scientific achievements, diminishing natural resources and increasing food needs necessitate a new approach for the future. The approach should exploit the

recent advances in genetic and molecular biology and our improved understanding of the nature of ecosystems.

The explosive ferment in "plant biotechnology" has accentuated two problems that have plagued the plant science community for some time. The first is the limited number of plant scientists, particularly those with expertise at the tissue, cellular and molecular level. Plant scientists are a minor component of most biology departments, and new amalgamations of botany and zoology departments, as well as patterns of faculty hiring in an era of constrained budgets, tend to reduce the number of active plant scientists. Graduate students in the biological disciplines traditionally have moved into areas that are better supported by Federal agencies. The new found interest of both large and small companies in plant biotechnology has resulted in their hiring many of the better plant scientists away from the universities.

The second problem is that the state of knowledge about plants, particularly in cellular biology and molecular genetics, lags behind that achieved in corresponding areas in the animal and microbial sciences. Thus, it is not yet possible to undertake many of the genetic manipulations that are considered routine in microbial systems.

A number of Federal agencies support plant science research: USDA, DOE, EPA, NIH, NASA, DOS(AID) and NSF. As indicated earlier, NSF provides the major Federal support for fundamental research in the plant sciences at colleges and universities. In FY 1982, within current resources, NSF will increase its contribution in these areas through special efforts for young scientists,

11-864 O - 83 - 19

augmented funding for meritorious proposals in plant molecular biology and special emphases in other key research areas.

In conclusion, may I return to an earlier point--solutions to problems require knowledge and the scientific talent to develop and implement solutions. Projections of need and availability of resources are made on the basis of extant knowledge and educated guesses about likely advances. Projections are imperfect. For example, the projections of food production increases by the year 2000 were based on likely advances in fertilizers and other chemicals--not the exciting advances in plant biotechnology. Unforeseen advances promote realization of goals, while problems (technical or otherwise) delay realization of goals. Basic research contributes to the knowledge base necessary to resolve problems. Setting national research goals for agricultural productivity and the fundamental knowledge that underpins future agricultural practices and innovations requires continuing appraisal. Collaboration and effective communication of the knowledge base developed by scientists across the country through support from NSF, USDA, and other agencies with related research missions are key aspects of this enterprise. NSF's most effective role will be to continue to support research that identifies and pursues the most promising avenues.

Mr. SCHEUER. That was a very thoughtful and stimulating piece of testimony.

We appreciate it very much.

Now, we will hear from Dr. Emery Castle, president of Resources for the Future.

Perhaps you would chat with us informally for 8 or 10 minutes.

Mr. CASTLE. I am sure 8 or 10 minutes will be plenty of time for me to provide a summary of my testimony. I do indeed appreciate this opportunity to express my views on this very complex and important subject.

I would like to begin by stating what perhaps is an obvious consideration: That the public's investment in agricultural research over the years has yielded a very handsome rate of return.

This is documented by scholarly research, but if we just look around and see what has happened to the real cost of foodstuffs over time, the amount of farm labor that has been released to nonfarm employment, and what has happened to agricultural exports, we will know that we do have indeed a very productive agriculture; it is logical that our agricultural research and educational system can take at least a part of the credit.

One might ask, then, what is the problem? Why is it that so many studies have come forth that have been critical of the agricultural research establishment, when it apparently has been no productive?

One might ask why not just continue the way we are?

Part of the answer lies in the uniqueness of the system, itself; that we try to apply a fairly naive kind of measure to its performance, but a proper evaluation of its performance requires a fairly sophisticated kind of analysis.

The system that has evolved over the years is a decentralized one. Project leaders, department heads, deans within the universities, have been able to exercise a considerable amount of autonomy in their selection of research projects, in their selection of personnel, but, in addition to that information come into the system at many different levels which has affected the productivity of the system. The system has been close to the users, and, in general, has been quite responsive to their needs.

There is tension, of course, within such a system, and at times this tension has verged on the unhealthy and the coordination of such a large and decentralized system has become a very major problem.

Many years ago, Congress wisely mandated joint planning between USDA and the land grant institutions, and, since that time, there has been a progression of steps designed to provide for even closer coordination.

These steps have always had very laudable objectives such as the establishment of research priorities, elimination of duplication, and the provision of better communication. But in many instances these efforts have been counterproductive.

The system is so very vast and so very decentralized, that to be truly effective, any central control group, whether you call it the joint council or some other name, would have to have a very large staff and would have to control budgets.

If this were to happen, the decentralized system would no longer be decentralized and this would destroy a very large part of the creativity of the system. It would eliminate the freedom that the researcher has to pursue promising ideas and the opportunity of users to register their thoughts and their needs at different points within the system.

In my view, coordination and joint planning at the national and regional levels should be modest in scale, and the expectation of what it can accomplish should be lowered appropriately.

Now, let me be specific with respect to what I think regional and national coordination efforts should do.

I think they should emphasize the formulation of long-term objectives and broad development strategies for the system as a whole, including the establishment of broad areas of emphasis by the USDA and the State agricultural experiment stations.

Mr. Chairman, I speak here from some experience, because I served 1 year on the Joint Council, the first year that it was in existence.

I would like now to turn to four things that I think can be done to improve the productivity of the system.

First, I would let the State agricultural experiment stations establish research priorities for their States, even when Federal funds are involved. I think the competition among States to improve agriculture is so keen that they can be counted on to use well whatever funds they have available.

Indeed, the fact that State appropriations have been growing is evidence that the States believe research is one way for them to make their agriculture more efficient. Furthermore, the freedom that can be granted to the individual researcher is attractive to the more innovative and imaginative research scientists.

Regional coordination among the State agricultural experiment stations and regional USDA research units clearly is needed, but, as I have suggested, such efforts will be most effective when they are least ambitious. That so much time of the most able people within the system now is spent on unproductive coordination and planning argues strongly for modest goals and modest efforts.

I do not pretend to great expertise on USDA research. Yet, it is clear that left to their own devices and resources, the State agricultural experiment stations will emphasize local and regional problems and often neglect national issues.

It is the truly national problems that should command the attention of the USDA. This is a most appropriate issue for the attention of the Joint Council. Is the USDA working on national issues or duplicating State efforts? The experiment stations should not be precluded from working on national issues. Indeed, they have produced some of the best research on national agricultural policy, but I believe the inevitable pressures they face will force them to emphasize more parochial interests.

I have very little confidence in the establishment of centralized research priorities, for I have engaged in such activities and know the inevitable result is compromise that makes little scientific sense. I also know that the more imaginative researchers will resist or circumvent an imposed set of priorities.

The way to motivate a scientist is to present him or her with a problem or puzzle to be solved. This is best done at the working level, not in Washington, regardless of how able the people are who do the central planning.

Second, agricultural research should be funded through a dual system employing formula funding and competitive grants. Unfortunately, the two have been viewed as alternatives when, in fact, they are quite different techniques that best serve very different objectives.

Formula funding is the traditional means of distributing Federal funds to the State experiment stations for agricultural research. Its defenders argue that the productivity of the system is due in large part to this dependable source of funds. Critics say those who receive the funds have little performance incentive because the funds are forthcoming regardless of performance. They would replace formula funds with competitive grants that would bring agricultural research in conformity with the funding of scientific research generally.

I believe formula funding should be continued because it provides for program continuity and it recognizes that output from the agricultural research system cannot be packaged neatly into journal publication and specific research results.

Formula funding permits the expertise gained by researchers over time to serve those who use research results in ways other than by published research. When I was a research administrator in a State agricultural experiment station, I could not have built a good program, except in a narrow academic sense, entirely on competitive grant funds.

I have little doubt but that formula funding once contributed to complacency within the experiment stations—and possibly in the USDA. I think that resulted in a failure to keep abreast of scientific developments, an aloofness about important problems, or both.

However, the financial situation of the past decade or so has generated great administrative pressure on many researchers to obtain other funds to support their research. Often this has resulted in experiment station people moving out of agricultural research; they went where the funds were.

I believe an expanded program of competitive grants is justified to attract the best people to agricultural research and to make agricultural researchers competitive with the top people in their disciplines. Moreover, competitive grants should be available to every agricultural research discipline, and they should not be limited to the State agricultural experiment stations.

A third category of grants—program improvement grants—could serve a most useful purpose. Such funds would be available on a competitive basis only and would be used to modernize or improve the program of any organization doing agricultural research. These grants could be administered by USDA, but not necessarily; however, they should be reviewed by people in the academic community generally. In particular, neither the reviewers nor the recipient organizations should be limited to experiment station personnel nor the State agricultural experiment stations as organizations.

My third point is that there is a very great need for public and private relationships in agricultural research to be examined and

for guidelines to be established, assigning responsibility to the private and public sector.

Dr. Prager made the case for this. I will not go into detail except to endorse the need for this. I believe that we have only a very murky idea at the moment as to precisely what areas of research would be supported in the private sector if public sector research were not underway.

I think it would be very easy to make some inappropriate decisions based on what we think we know; so of some guidelines need to be established. Certainly and a study should be a joint public-private sector effort.

My fourth point is that I would underline the importance of measures which would maintain the credibility of the agricultural research system, and I think this takes two forms: One, I believe the system needs to make it clear that it is operating on the basis of scientific principle, that it is not simply serving an industry, but society more generally. It is to the credit of the system that its credibility has not been more seriously challenged than it has been, although there have been instances where its objectivity has been called into question.

In conclusion, Mr. Chairman, I would register my support for a strengthened publicly supported system of agriculture research and education. I believe that we run risks from too much central coordination and planning. failure to understand the effects of different forms of financing, confusion over the proper role of public and private research, and danger that the credibility of the system will be eroded.

Thank you very much for this opportunity.

[The prepared statement of Mr. Castle follows:]

STATEMENT TO THE SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH AND ENVIRONMENT
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

Emery N. Castle, President*
Resources for the Future, Inc.

July 29, 1982

Thank you for this opportunity to express my views on the organization and administration of agricultural research in the United States. The subject is most important; it also is exceedingly complex, and the subcommittee is to be complimented for seeking a variety of views.

Let me begin by stating what should be obvious despite the numerous criticisms leveled at the system, that is, the public's investment in agricultural research has yielded a handsome rate of return. This is documented by an impressive body of careful, scholarly research that has established very high rates of social return on their public investments. But one does not have to follow the academic literature to know that American agriculture has been so productive that the real cost of foodstuffs has fallen, farm labor has been released for urban employment, and agricultural exports have increased to the point where they constitute a third of our total production. Surely our agricultural research and educational system can take some part of the credit—perhaps a major part—for these impressive accomplishments.

Why, then, is there a problem? Why is it that several recent studies have been critical of the agricultural research establishment and that many have recommended drastic reform?

---

*The views expressed in this statement reflect my individual thinking and do not in any sense constitute a position of Resources for the Future.

I believe the answer lies in the uniqueness of the system that has evolved and the complexity of agricultural research itself. While many parts of the system probably can be improved, adopting some of the proposed recommendations could well destroy the system in the name of reforming it.

The USDA-land grant university partnership that has evolved over the years has some interesting characteristics. For example, the system traditionally has been decentralized, that is, project leaders, department heads, and deans within the universities could exercise considerable autonomy, as could their counterparts within USDA. Decentralization also has enabled information to flow into the system at many different levels. The system has been close to the users and typically has been quite responsive to their needs, but a degree of tension always has existed between the partners and at times this tension has verged on the unhealthy.

Coordinating such a large decentralized system has become a major problem. Congress years ago wisely mandated joint planning between USDA and the land grant institutions, and subsequently there has been a progression of steps designed to provide for closer coordination. These steps have had such laudable objectives establishing research priorities, eliminating duplication, and providing for better communication among scientists, but many of the recent efforts have been largely counterproductive. The system is so vast and so decentralized that to be truly effective, any central control group—called the Joint Council or by some other name—would have to have a very large staff and would have to control budgets. But if this were to happen the decentralized system no longer would be decentralized. I believe this would destroy a very large part of the creativity of the system—the freedom of the individual

researcher to pursue promising ideas and the opportunity of the users of research to register their thoughts and their needs at different points within the system. In my view, coordination and joint planning at the national and regional levels should be modest in scale and the expectations of what they can accomplish should be lowered appropriately. Since "modest" might be invested with different shades of meaning, let me be specific. I believe that national and regional efforts should emphasize the formulation of long-term objectives and broad development strategies for the system as a whole, including the establishment of broad areas of emphasis by the USDA and the State Agricultural Experiment Stations (SAES).

It is inevitable that a large, decentralized research and educational system will appear to be uncoordinated, duplicative, and lacking a good basis for establishing research priorities. And, to a certain extent, all these things are true. But they are only marginally relevant if the system performs well and yields a high return on the taxpayer's dollar. Four things can be done to improve the chances that that will happen:

1. Let the state agricultural experiment stations establish research priorities for their states even when federal funds are involved. The competition among states to improve agriculture is so keen that they can be counted on to use well whatever funds they have available. Indeed, the fact that state appropriations have been growing is evidence that the states believe research is one way for them to make their agriculture more efficient. Furthermore, the freedom that can be granted to the individual researcher is attractive to the more innovative and imaginative research scientists.

Regional coordination among the state agricultural experiment stations and regional USDA research units clearly is needed but, as I have suggested, such efforts will be most effective when they are least ambitious. That so much time of the most able people within the system now is spent on unproductive coordination and planning argues strongly for modest goals and modest efforts.

I do not pretend to great expertise on USDA research. Yet, it is clear that left to their own devices and resources, the state agricultural experiment stations will emphasize local and regional problems and often neglect national issues. It is the truly national problems that should command the attention of the USDA. This is a most appropriate issue for the attention of the Joint Council. Is the USDA working on national issues or duplicating state efforts? The experiment stations should not be precluded from working on national issues. Indeed, they have produced some of the best research on national agricultural policy, but I believe the inevitable pressures they face will force them to emphasize more parochial interests.

I have very little confidence in the effectiveness of centralized research priorities, for I have engaged in such activities and know the inevitable result is compromise that makes little scientific sense. I also know that the more imaginative researchers will resist or circumvent an imposed set of priorities. The way to motivate a scientist is to present him or her with a problem or puzzle to be solved. This is best done at the working level, not in

Washington, regardless of how able the people are who do the central planning.

2. Agricultural research should be funded through a dual system employing formula funding and competitive grants. Unfortunately, the two have been viewed as alternatives when in fact they are quite different techniques that best serve very different objectives.

Formula funding is the traditional means of distributing federal funds to the state experiment stations for agricultural research. Its defenders argue that the productivity of the system is due in large part to this dependable source of funds. Critics say those who receive the funds have little performance incentive because the funds are forthcoming regardless of performance. They would replace formula funds with competitive grants that would bring agricultural research in conformity with the funding of scientific research generally.

I believe formula funding should be continued because it provides for program continuity and it recognizes that output from the agricultural research system cannot be packaged neatly into journal publication and specific research results. Formula funding permits the expertise gained by researchers over time to serve those who use research results in ways other than by published research. When I was a research administrator in a state agricultural experiment station, I could not have built a good program, except in a narrow academic sense, entirely on competitive grant funds.

I have little doubt but that formula funding once contributed to complacency within the experiment stations—and possibly in the USDA—that resulted in a failure to keep abreast of scientific developments, an aloofness about important problems, or both. However, the financial situation of the past decade or so has generated great administrative pressure on many researchers to obtain other funds to support their research. Often this has resulted in experiment station people moving out of agricultural research; they went where the funds were. I believe an expanded program of competitive grants is justified to attract the best people to agricultural research and to make agricultural researchers competitive with the top people in their disciplines. Moreover, competitive grants should be available to every agricultural research discipline, and they should not be limited to the state agricultural experiment stations.

A third category of grants—program improvement grants—could serve a most useful purpose. Such funds would be available on a competitive basis only and would be used to modernize or improve the program of any organization doing agricultural research. These grants could be administered by USDA, but they should be reviewed by people in the academic community generally. In particular, neither the reviewers nor the recipient organizations should be limited to experiment station personnel nor the state agricultural experiment stations as organizations.

3. Public and private relationships in agricultural research urgently need examination and guidelines for private and public sector responsibility need to be established. Much agricultural research, whether publicly or privately supported, benefits many private sector firms, whether farms or large agribusiness firms or both. No one has a very clear sense of what research would or would not be carried on in the private sector if it were not done in publicly supported institutions. When research can be done privately, it should be. But the issues are very complex and quick judgments often are incorrect judgments. Private firms may not take on certain research because it is being done in a public institution, it not being to their advantage to assume this added cost, and some research undoubtedly would be picked up by the private sector if public support were discontinued. But, establishing a good research program in most fields takes a considerable amount of time and the shifting of responsibility from one sector to another cannot be expected to occur instantly or automatically. That is why guidelines are needed to provide a sense of direction and continuity.

4. It is essential that the credibility of the agricultural research system be maintained and Congress has a responsibility to help accomplish this important objective.

A research organization that serves an industry always risks being captured by that industry to the point where the research organization attempts to further the objectives of the industry at the expense of its own credibility with other segments of society. It is to the enormous credit of the agricultural research system that its objectivity has not been more seriously challenged than it has been. A system of competitive grants with accompanying peer review to supplement formula funding would strengthen the credibility of the system.

Politics raises another kind of threat. Should the USDA move more in the direction of competitive grants and possible program improvement grants, it is essential that the process of making these grants be apolitical. I cannot imagine anything more inconsistent with the proper objectives of an agricultural research system than to try to reflect the objectives of the administration in power at the moment by the choice of research projects.

Mr. Chairman, I have kept my comments quite brief on the assumption that you are more interested in major directions and general organization of the agricultural research system than an exhaustive examination of its various parts. I analyzed the agricultural research and educational establishment much more comprehensively two years ago. I believe my findings then still are valid today, and I am taking the liberty of attaching a copy to this statement. That study was made possible by grants from the Kellogg and Ford Foundations and was presented, in part, to the National Association of State Universities and Land Grant Colleges in November 1980.

In conclusion, I want to register my strong support for a strengthened, publicly supported system of agricultural research and education in the United States. Our society has benefitted greatly from past investment in the system. It is far from perfect, but in our attempts to reform it we risk destroying the essence of its uniqueness and productivity. We run risks from too much central coordination and planning, failure to understand the effects of different forms of financing, confusion over the proper role of public and private research, and danger that the credibility of the system will be eroded. The task of preserving the system and remedying its deficiencies is both difficult and important, and you are to be complimented for undertaking it.

Mr. SCHEUER. Well, thank you very much for your very fine statement.

Dr. Prager, these two charts illustrate the levels of research in several agencies.

You commented on page 2 of your testimony, the second paragraph, that large increases were planned for Federal R&D in fiscal 1983.

What is the size, as you would estimate it, of the increase in R&D we can expect for next year? What proportion of the increase for USDA is directed toward measurable and quantifiable long-term agricultural research objectives?

Mr. PRAGER. The overall increase for the Federal Government in research and development is something on the order of $4½ billion for fiscal year 1983. A large percentage of that is in defense. In basic research, we were able to get a 9-percent increase; but, again, a predominance of that is in defense, because of the administration's emphasis on national security.

A large part of the increase for agricultural research is aimed at basic science through the competitive grants program. To the degree that the competitive grants program is the one USDA program in which scientists select high priority research areas for funding and ask for proposals in those areas, this thrust represents an effort to develop national priorities and to fund research in those areas.

Mr. SCHEUER. On page 17, in paragraph 3—you don't give us the feeling that the Joint Council is going to make great strides in planning and coordination.

What do you feel the Congress can do about this, and what do you think the OSTP or the administration is going to do to encourage greater progress in planning and coordination by the Joint Council?

Mr. PRAGER. I think we expect much too much from the Joint Council. Dr. Castle will have to speak about his experience on the Joint Council. I sit on it, find it extremely frustrating, and seem to find excuses for not spending a lot of time at its meetings.

There are several problems in terms of long-range planning in agriculture.

One is the diverse, the decentralized nature of the agricultural research system. A major part of the research is done at the State level, much without Federal funding. The Federal Government provides only one-fifth of the funding going into State agricultural experiment stations.

Mr. SCHEUER. Where do the other four-fifths come from?

Mr. PRAGER. Most of it is State appropriations. As Dr. Castle so well explained, the agricultural research system was set up with State experiment stations to concentrate on State, local, and regional needs, and with a Federal system to concentrate on national needs. I think we have deluded ourselves by thinking that, because we fly around the country, holding a lot of meetings, doing a lot of "planning," and putting out a lot of reports, we really make a difference in what the States do. There are more plans for agricultural research than you can shake a stick at; yet, there has been very little change in behavior.

I will say one other thing which I feel is important. I don't think we can expect to have national goals for agricultural research until we have national goals for agriculture. I don't think that we have a clear national set of priorities or goals in this country for where agriculture is going. There is a lot of confusion now about the relationship between domestic agriculture and domestic markets and international markets and exports. The way in which the last administration and the Reagan administration have used or eschewed the use of agricultural products as economic forces abroad, shows some of the problems here.

Again, I don't expect much from this pluralistic system in terms of a great planning effort. I think Dr. Castle is correct. The planning should recognize what the States are doing, admit that they should be setting their own priorities, and then look at national needs and plan primarily what the Federal role should be.

Mr. SCHEUER. You gave us a whole broad range of criticisms of the present USDA long-term planning process. Taken as a group, these criticisms constitute a rather devastating indictment of the inadequacy of USDA's long-term agricultural research planning process.

Would you say that is a fair statement?

Mr. PRAGER. In terms of the ability of that process to affect behavior, yes, I would say that is true.

Mr. SCHEUER. It is very encouraging to me that someone in the administration is facing up to these problems. You apparently have made time to research the goal and priority-setting functions of the USDA in the field of agricultural research; as we have heard before, there seems to be great deficits in the area.

The GAO study and the National Science Foundation study and the CRS study pointed that out, but I did not get the impression 2 days ago that the USDA had really got the message from those studies that there is a great deficit area in their long-term agricultural research policy development.

Mr. PRAGER. That may be because——

Mr. SCHEUER. I didn't get the feeling that the USDA spokesman had much zest for really bringing his office into the 20th century and making some of the changes that these three studies were quite unanimous about—and there was quite a clear consensus. He seemed to be oblivious or unconcerned—I was not quite sure which—about the charges, rather similar charges which they all made.

Can you give us any insight as an administration spokesman on whether the Department of Agriculture will get some leadership from the administration, and whether the Assistant Secretary will be given some help and encouragement in leading his agency to make the changes that you have indicated so very clearly and effectively have to be made?

Mr. PRAGER. Let me start by sticking up a little for Dr. Kinney, who testified for the USDA on Tuesday; he is in an acting capacity, and has only been in that position for a short time. It is beyond the scope of what he normally deals with. I find him to be one of the most innovative and thoughtful of the bureaucrats with whom I deal in that agency, or any other, for that matter. In his regular capacity of administrator of the Agricultural Research Service, the

in-house Federal laboratories, Dr. Kinney, more than anybody else, has been urging a mechanism to bring the States and the Federal Government closer together. Also, he has been innovating some contacts between his organization and industry; so I think he understands the need you're addressing.

I think there is a problem in the bureaucracy, generally, in that there is a focus on the process of planning and not on the outcome. Reports such as these from GAO, OTA, or CRS tend to look at the output of the planning process and say: Yes; a lot of paper came out, but it did not have much effect on the system. The bureaucracy will tend to say: We did our planning; here is the plan that we did; and next year, we will do another one. There is not—particularly from the Federal side—a focus on whether or not that plan had any effect.

I would like to say again that I have relatively slight expectations for the success of planning unless we are more realistic about what that planning will attain. I am not sure that I know what we will accomplish by doing different kinds of planning or involving other kinds of people.

I have thought a lot about what to do with the Joint Council to make it effective. I don't see a way to make it effective as long as each person there is primarily there to speak for his or her institution, and protect that institution's turf. We have not gotten to the point where the institutions understand one another, welcome each other's inputs, and actually work together.

There is a lot of lip-service paid to working together, and there is cooperation at the scientist-to-scientist level. But, there are still a lot of turf battles going on. I feel that the traditional system, the experiment stations, and the Department still are not exactly welcoming with open arms the other research institutions who can contribute to this country's agricultural research capability.

Mr. SCHEUER. Well, you have in your initial testimony lifted our hopes, showed us a great new world out there, and now you are telling us that it is all a chimera.

Mr. PRAGER. I am saying the same thing Dr. Castle said: The way in which we will attain real planning and real coordination is by concentrating on science. I think that the preponderance of the planning and coordination that goes on was between the States and the Federal Government is over budget. My sense is we ought to cut off airplane tickets for anyone who flies from a land-grant school to Washington to talk about budgets.

We ought to talk about science. We should identify scientific needs and say: Here is a consensus of the areas of science which we think are very important. Anybody out there in the land grant system, in the USDA, in industry, or in public or private universities, who can help us on these projects, send in your proposals, and we will try to make funding available.

If we can focus on the science and get away from focusing constantly on budget and administrative issues, we will, in fact, accomplish a tremendous amount in terms of long-range goals and coordination, because they will be scientific goals.

Mr. SCHEUER. How can you coordinate the long-term agriculture R&D scientific goals?

11-864 O 83 - 20

Can that be done without considerable reorganization with USDA?

Mr. PRAGER. I think it can. I am not saying that there should not be some reorganization. I think that the ARS, for example, requires some refocusing, through the establishment of some centers of excellence that really conduct basic research in a strong way.

We probably need to do something which is politically not very popular, cut back on some of the large number of ARS centers in this country. I don't think you have one in your district, so we might be able to start there.

Mr. SCHEUER. If you have one in the Bronx, Queens or Nassau County, something is rotten in Denmark; but, I would welcome one in my district. Looking at it from the long term, the year 2000, the year 2010, 2020, I would venture to say that very, very few of the enterprises that our Congress and our executive branch are supporting will so criticially determine the quality of life in our country as the kind of work we are discussing here today.

We Members of Congress go through a lot to get reelected to come down here, and most of us are very keenly involved in the work we are doing and feel it is important, feel it is a great privilege.

Well, when I consider all of the work that I am doing on all of the committees that I serve on, I don't know of anything that is as critical for the quality of life, not only here, but around the world, as this whole area of long-term agricultural research.

To me, it is enormously exciting. It makes all those 5 a.m. stops to shake hands at the subway stations acceptable and, on some kind of cost benefit scale, meaningful.

Mr. PRAGER. We will remind you of that in October.

Mr. SCHEUER. We are going to have a set of hearings on this, and we have not hit on this today; perhaps all of you could think and chat about, for a moment, the kind of long-term agricultural research that we ought to do that is not only appropriate for our own small-scale, small-acreage farmers, but for farmers in the developing world.

I feel uncomfortable with the role that is sometimes foisted upon the United States of being the food supplier of the world. We can't be the food supplier of the world indefinitely—not with the global population increasing by 2 billion between now and the year 2000—and if we are judged by those standards, we are going to be judged unfairly.

It seems to me our role is less to provide all the food for the developing world's rapidly increasing food needs than it is to show them the way and provide them the insights, technology, and knowledge base that they need to supply their own food needs.

In times of yore the developing world supplied its own food needs. Every country in sub-Sahara Africa was a food exporting country. They are now food-importing countries, and that is a very sticky wicket.

The world is not going to continually and systematically send them billions of dollars of food every year. They somehow have got to achieve their own equilibrium between food supplies and population, and therein lies an enormous challenge for our long-term agricultural research policy establishment.

How can we show them—how can we show them the way in terms of new plants, new fibers, that small-scale, small-acreage farmers in their part of the world can produce? How can we provide them seeds and plants that are drought resistant; that are blight resistant; and that do not require large inputs of fertilizer and irrigation—both of which are tremendously energy-intensive, when they are in an era of $40 a barrel oil prices?

How do we help them increase the productivity of the individual small-scale farmer? Surely not by exporting enormous combines. The developing world has a desperate problem of job creation. Between now and the year 2000, the developing world will have a shortage of about 750 million jobs. That is more than the entire employed population of the developed world; their need is not for labor-saving agricultural technology that is capital-intensive. It seems our job is to help them find appropriate technology that will increase the output of the individual farmer by small inputs of capital.

If we can figure out a way of giving them appropriate or intermediate technology and the plants and the seeds that are appropriate to their part of the world—pest resistant, blight resistant, and drought resistant—then maybe we will have helped them find the way to achieving equilibrium in their own countries between population demand and food supplies.

That will be a tremendous humanitarian feat if we can pull it off.

We have the capability; we have the genius in our American agricultural research community; it is there but needs mobilizing, harnessing, and better communication.

I do not think that total centralization of agricultural planning makes much sense, either. I have had too much experience in the last 16 years in Washington to feel that to have the long arm of the Federal Government reach out to all of those institutions assigning each a role and cracking the whip is a constructive approach; it is not. It is a futile and an offensive approach.

The talent lies within your community, and the question is how do we mobilize it; how do we establish priorities and establish goals from within the agricultural research community, and not imposing it upon that community, but encouraging the community to produce it, itself, so that it is coming from within.

That is what Congress wants, and that is what the American public wants.

I am particularly interested in hearing if any of you wish to address yourselves to the question of how we produce the kind of seeds, plants, crops that are appropriate to those Third World agricultural, weather, manpower environments, and what the role of the Federal Government should be in moving that process along?

Mr. PRAGER. I would defer to Dr. Castle.

Mr. CASTLE. I certainly have given a bit of thought to this.

I think that there are several ways that we can help food needs around the world. You mentioned agricultural exports, food, itself, and that is the one we usually think of first.

Mr. SCHEUER. We have to stop thinking of that as the exclusive answer. Of course, it is part of the answer, and, of course, we are the breadbasket of the world, and we will continue making our

large contribution; but, an even more noble and wise goal is to help the countries of the developing world help themselves.

The rich uncle is never a very popular guy on the block, and neither is the rich country that is always giving of its largesse; because it is, in a sense, robbing these other countries of self-sufficiency—the ability to feed their own people within the confines of their borders.

What can be a more basic function of a government and a society than to feed its own people? The continuous dependence on outside sources of food first is not very viable. It is not likely to be dependable; and, I think it is an unhealthy reliance.

Countries, like people, like to feel independent, to feel that they can make it on their own, and that they should be able to make it on their own. We should encourage these countries much more so than we are to develop this capacity—to look down the pike 20 years and lay the groundwork now, the policy and program formulation to achieve equilibrium between population and food.

Mr. CASTLE. We can assist in the training of their scientists who can discover things within their own culture and their own economies that can be used there.

We have done a good bit on that. More for certain parts of the world than for others. But that is one very fundamental thing.

We can encourage research, itself, within those countries, either by making funds available or by making our people available to them in their setting, to work with their scientists and working in that situation even if independently.

The third is the export of technology, itself. Sometimes we have technology that can be used within their situation, but, as you quite correctly recognize, the technology that we develop to fit our situation often is not the technology that is best applied within theirs.

So there are those three things that we can do, and there are starts in all three areas, but one of the most encouraging things from my standpoint that I see is that there is an increasing investment within these developing countries of their own funds in agricultural research. They recognize the importance of research to the longrun food needs, and I think that certainly is a move in the right direction.

Mr. SCHEUER. We had representatives of some of those 1890 institutions here a couple of days ago.

We got the very clear impression from them that they felt that their institutions had a role to play in stimulating research in the developing countries, particularly in Africa, to manage training centers for researchers, helping to train and direct researchers, in cooperative projects in the field in these countries. I think that this is one area that has been underemphasized, and in which there is vast potential for us to contribute to the ability of developing countries to meet their own food needs a decade or two or three down the pike.

Do you have anything you would like to contribute, Dr. Brooks?

Mr. BROOKS. Yes, Congressman Scheuer.

I am not an agricultural expert, but I would like to say I was heartened by your comments about the state of agricultural needs in this country and in the developing countries.

I think, taking a really long-range view, that some of the needs that we see now in the developing countries are needs that we are going to have right in this country further along the pike.

Water is getting more and more unavailable in the West. It is essentially a desert, although nobody really wants to face up to the fact. We can't afford really to use petroleum-based fertilizer and pesticides to the extent that we have before.

If our population continues to grow, we will have to use marginal arid lands more extensively than we have. We should learn to use, if possible—and there are indications that it can be done—diluted sea water for fresh water, as a substitute for fresh water.

These are technologies that we might look forward to developing for use within our own Nation, which could also be easily transferred to other parts of the world.

Mr. SCHEUER. Dr. Huang, you have been sitting here. Is there anything you would like to contribute?

Mr. HUANG. If I may, I would like just to add that we have talked in our presentation about advances in biotechnology, and I think no one can predict today what kind of advances will appear. It is a most fruitful area that is at the cutting edge of science today, and perhaps we will have some answers for the kind of plants that you talked about coming out of this type of research work currently and in the future.

Mr. SCHEUER. Any further comments?

Mr. PRAGER. I think the international area is an area where the Federal Government has a clear role to play in helping to define needs and being a central coordination point for working with the developing countries; not telling everybody else what to do, but and making sure the capabilities are optimally used.

One of the reasons we have not been more of a leader in achieving what you were describing is that the Federal Government has not provided that leadership through the USDA.

Mr. SCHEUER. So I think that some clearer focus in USDA is overdue in terms of defining the kinds of long-term agricultural research that we ought to be producing to help the developing countries achieve food independence.

Mr. PRAGER. Yes.

Mr. SCHEUER. Our minority counsel would like to ask a question.

Ms. BACH. As a followup on world food production needs, there has been research done at midwestern universities on perennial strains of corn. What are your comments in terms of the prospects for this type of research, and what consequences might this type of production of strains of corn have on food production for some of the underdeveloped countries; what sort of consequence may it have on soil erosion, water needs, and crop productivity?

Is this a feasible direction for research? Are there countries that could pursue this?

The research that I am currently familiar with is trying to produce strains of corn by cross-fertilization. I would appreciate your comments or the comments of the panel.

Mr. BROOKS. Again, let me qualify my response by saying I am not an agricultural expert, but we are interested in this perennial corn business, because it was one of the scientists NSF supported in the Systematic Biology Division. It may possibly be—I don't

know what you are referring to—it may, by crossing it with maizes, we know it may produce a perennial variety, and, of course, this would cut down on tillage and certainly might help soil erosion.

What would the fertilizer requirements be, the effect on pest problems, if you had a perennial plant, planting corn, for instance, and you say you could not rotate it for something else; that is one way of getting rid of pests. You would probably have to solve a suite of pest management problems along with it.

This is not a total panacea. It is a possibility that has to be explored. It is possible that it might be useful in some other country, but I would defer to Dr. Castle.

Mr. CASTLE. I have very little to add.

I think Dr. Davis has identified both the potentialities as well as the problems quite accurately.

Mr. SCHEUER. Dr. Prager, you just mentioned that you thought there was a significant Federal role in producing the kind of agricultural research that is appropriate to the developing world.

Can you tell us where it ought to come from, what is that role, if you could? Help us define that role, and if it is in USDA, what kind of changes would have to take place over there to equip them institutionally and organizationally to play that role.

Mr. PRAGER. The highest priority change would simply be to upgrade the scientific capability of USDA.

If we are successful in upgrading the scientific capability of USDA laboratories, defining a specific mission for those laboratories, tightening the administration, getting rid of some of the layers of administration and making the ARS a tight ship focused specifically on high-priority science, that, in itself, would do a great deal to help to focus some of that capability in the department.

Then I think there would have to be a specific focus within the department on international research. The office which coordinates such research recently has been taken out of science and education.

Mr. SCHEUER. Would you suspend? I am not sure whether this is a 5-minute vote.

We are going to suspend.

[Brief recess.]

Mr. SCHEUER. The committee will come to order.

Please continue, Dr. Prager.

Mr. PRAGER. I was saying that I think the department can form the focus for providing the scientific leadership that is necessary to link the capabilities in this country with the needs abroad, and to bring together clearly the capabilities which are in the land-grant community, the other universities and industry. There are many capabilities that need to be brought together.

Dr. Castle reminds me that there is also an Agency for International Development, which plays a large role in international research programs. The former Director of Science and Education in USDA, Dr. Betrand, just went to AID. Peter McPherson, the Administrator at AID, feels very strongly about lessening the concessional relationship between this country and foreign countries and getting back to a scientific and technical relationship in which we help them train people, help them develop the technologies, themselves, and become self-sufficient.

So there needs to be a relationship, a working relationship, between AID and the Department of Agriculture. That relationship has not always been a good one. There is a role for the department, and I think there will need to be a focus within Science and Education on international issues.

Mr. SCHEUER. Any final comments?

All right. Let me say this has been a very, very thoughtful, stimulating, and thought-provoking panel. We appreciate your patience and enjoyed your testimony very much.

Now, we will suspend for 12 or 15 minutes.

[Recess.]

Mr. SCHEUER. The subcommittee will come to order.

Now we will hear our next panel, Dr. James Tillotson, vice president for technical research and development, Ocean Spray Cranberries, Inc., and Dr. Harold Wilcke, retired, vice president for Research, Ralston Purina Co.

STATEMENTS OF JAMES E. TILLOTSON, PH. D., VICE PRESIDENT, TECHNICAL RESEARCH AND DEVELOPMENT, OCEAN SPRAY CRANBERRIES, INC., AND HAROLD L. WILCKE, PH. D., RETIRED, VICE PRESIDENT FOR RESEARCH, RALSTON PURINA CO.

Mr. SCHEUER. We are very happy to have you both.

Your full testimony, as you have prepared it, will be printed at this point in the record, so we would hope that you could chat with us informally for 8 or 10 minutes, giving us the highlights of your testimony—also you may speak to anything that you have heard today, any of the testimony of the previous witnesses—and then we will have some questions for you.

Dr. Tillotson, please proceed.

Mr. TILLOTSON. In my testimony I would like to focus on one area of the Nation's research needs in food and agriculture over the next two decades.

Mr. SCHEUER. Would you pull the mike a little closer?

Mr. TILLOTSON. As I said, I would like to deal with one area in food and agriculture. That is the area of postharvest technology.

This is roughly the area that encompasses all that happens to a food product from the time it leaves the farm until the consumer buys it. This is the area of technology that I am concerned with and my company practices.

I might add that the postharvest technology is an area that adds a significant cost to the price that consumers pay for food.

In your invitation to testify today, you requested that I address two issues: First, the role and capacity of the food industry to conduct research aimed at increasing long-term productivity; and, second, the role of the food-producing industry in establishing future and long-term national research goals for food and agriculture.

My views and comments are affected by the 13 years I have spent as research director of Ocean Spray.

Earlier, I was in the agriculture chemical industry with Du Pont, and I am a member of a number of trade associations dealing with postharvest technology.

I also was fortunate enough to serve on the advisory committee to the Office of Technology Assessment in their review of agricultural research.

The role and capacity of the food-processing industry to support basic and long-term research in postharvest technology is often misunderstood by those not familiar with our industry.

As the committee is aware, the food-processing industry is a highly competitive and price-sensitive industry. Ours is not a technology-driven industry in comparison with the drug, chemical, or electronics industries. The financial structure of the food industry does not allow a proportionately large investment for research activity when compared to other industries. It is very difficult, due to the traditional nature of our products, for one company to benefit significantly from direct investment in basic research.

Our industry's successes with technology have come through applied product and process research, and I stress the applied. Historically, we have been dependent on sources outside the industry for basic research in science and engineering.

The marketing and financial structure of our industry, as well as the historical sources of our new technology, has had a marked effect on the organization and direction of our technical activities. The technical resources of a majority of food companies are used primarily in the following applied areas: New product development; modifying and reformulating existing products; solving quality-related problems; packaging changes; process development; and Government regulatory issues.

We do not conduct and are not equipped to undertake basic research aimed at increasing fundamental knowledge in science and technology on which advancements in postharvest technology will come. It is unlikely, in my opinion, that the industry, given its present structure and resources, will change its current research orientation.

Even within the total agribusiness industry, the rate of investment for research and development in the food industry is less than other segments of agribusiness. The animal drug industry allots approximately 12 percent of their total sales dollars to research; the pesticide industry, 10 percent; the farm machinery industry, 3 percent; the fertilizer industry, less than 1 percent.

The food-processing industry allots less than 0.5 percent of their sales dollars to research and development. The average figure for research and development for all types of industry in the United States is approximately 3 percent of total sales dollars. I have a source for that information.

In November 1981, Food Processing magazine published the results of a survey of the 100 largest food-processing companies in the United States. By the way, we just made the list. These companies range in annual sales from $300 million to several billion dollars. This group was asked the extent of their research and development budget.

Among this group, 58 companies reported spending one-half of 1 percent of total sales dollars on research; 32 companies report spending in the range of one-half to 1 percent; and the remaining 10 companies spend in the range of 1 to 1½ percent of total sales on research.

It is apparent to those familiar with the industry's technical resources and abilities that only a very small number of companies have the appropriate staff, facilities, or budget to engage in any type of research that could be considered basic or long term in nature.

Historically, the food-processing industry has obtained its new science and technology mainly from two general sources. First, the laboratories and pilot plants of USDA, State agricultural experiment stations, and university food science departments. The basic technology that went on to develop original concentrate for frozen concentrate was developed in USDA laboratories in the 1940's.

Second, a major source of new technology is our suppliers of ingredients and processing and packaging equipment. We are assemblers.

We get new corn sweeteners, new packaging machinery. They come with the new technology that we use.

There is strong evidence that our ingredient and equipment suppliers are, in turn, also dependent on basic research conducted in the same Federal, State, and university laboratories.

In the past, the technology we received from our ingredient and equipment suppliers has been mainly from American companies. There is some question if this will continue to be the case in the future.

In the previously mentioned survey conducted by Food Processing, the research management of the 100 largest American food companies were asked the following question with regard to postharvesting technology: "How do you rate the level of R&D being carried out in the United States, Europe, and Japan?" This is a summary of their reply with the No. 1 rankings shown in the table.

A. New product development: Europe, 12 percent; Japan, 18 percent; United States, 70 percent.

B. Packages/packaging: Europe, 56 percent; Japan, 23 percent; United States, 21 percent.

C. New process development: Europe, 32 percent; Japan, 30 percent; United States, 38 percent.

This limited survey indicates, as we might expect, that we maintain an edge in new food product development. However, this group ranked European research and development in the area of packaging superior to the United States by a margin of more than 2 to 1. At the present time in the area of new process development, the United States is approximately equal to European and Japanese efforts. This survey suggests that in the future American manufacturers may have additional competition in their efforts to supply the food industry with processing and packaging equipment.

In my own company, approximately 5 years ago, we became concerned about the rising cost of packaging for our products. We began to explore alternate containers to our traditional cans and glass. After an extensive survey, we felt that alternate packaging systems were not available in this country; and we sought alternatives in Europe. The result of this commercial development effort was the introduction early in the summer of 1981 of our products in flexible containers, which we termed the "Paper Bottle." I have one here.

Mr. SCHEUER. Here we are. They are very tasty, I might add.

Mr. TILLOTSON. Thank you. That is one of our new products.

This represents a saving to the consumer and also an opportunity for us to take a greater market share, so we both benefit.

Mr. SCHEUER. I would think environmentally speaking, this would be an advantage over either glass or metal containers.

Mr. TILLOTSON. Yes; this was another concern of ours.

Mr. SCHEUER. Is it biodegradable?

Mr. TILLOTSON. Not completely. There is a small bit of foil there that is not.

It certainly is better than a glass or metal container.

Mr. SCHEUER. Yes.

Mr. TILLOTSON. I have told you, this equipment that makes this package is supplied by foreign equipment manufacturers.

Their research was helped by Government laboratories in their own country.

I might add, Ocean Spray's capital investment to date in this packaging equipment is in excess of $12 million. We expect by 1986 to invest a total of $25 million to $35 million in new equipment to manufacturer paper bottles. The majority of this equipment will come from foreign manufacturers.

In the interest of time, I have a few other remarks, but the story I am trying to tell here——

Mr. SCHEUER. You are pretty close to the end. Go ahead.

Mr. TILLOTSON. Thank you.

The technology was not here. We had to go elsewhere. There was significant work done in laboratories of governments in Europe on the food technology, the microbiology and other factors that helped the companies develop this packaging.

Let me go on to the second question I was asked to address—the role the food-processing industry can play in establishing long-term research goals.

Technical groups in the food industry should continue and expand their role in helping to identify areas that require development of new basic knowledge in science and engineering that will have significant benefit to the food-processing industry. We should also be users, testers, and adapters of the scientific results from Federal, State, and university laboratories. There is distinct room for improvement in the quality of advice and counsel that the food industry currently offers to USDA.

In recent years, the interaction between the food industry and the USDA research segment has been affected by doubt about the firm commitment on a national level to the importance of research on postharvest technology by USDA.

Industry committees, representing major commodities, could play an important part in helping to reestablish this interaction and to assist in establishing suitable long-term research goals and objectives for USDA research.

As a member of the Advisory to the Office of Technology Assessment, which recently completed its study of the food and agricultural research system, it is quite obvious that improvements can be made in all phases of the USDA research organization. This includes the management of research, the manner in which research objectives and goals are identified, how research is conducted and how these results are disseminated. I believe there is a general sen-

timent in the food industry that much can be done to improve the caliber of postharvest technology research in USDA laboratories.

Since 1972, a series of studies have been completed on the capability of the USDA research organization and its laboratories. These studies, including the latest by the Office of Technology Assessment, suggests a variety of options to improve the USDA research system. Unfortunately over a 10-year period, little progress has been made in improving USDA research.

Thank you, sir.

[The prepared statement of Mr. Tillotson follows:]

STATEMENT OF JAMES E. TILLOTSON PH. D., VICE PRESIDENT, TECHNICAL RESEARCH AND DEVELOPMENT, OCEAN SPRAY CRANBERRIES, INC.

Mr. Chairman, I am James E. Tillotson, Vice President of Technical Research and Development, Ocean Spray Cranberries, Inc. Ocean Spray is a farmers' cooperative representing growers of cranberries in the states of Massachusetts, New Jersey, Wisconsin, Oregon and Washington. My company is engaged in the processing and distribution of fruit products and has plants located in Massachusetts, New Jersey, Wisconsin, Washington, Florida and Texas.

In my testimony this afternoon, I will focus on one area of our nation's research needs in food and agriculture over the next two decades. This is the broad area of postharvest technology. As you are aware, this area of technology concerns itself with the handling, processing, packaging and distribution of agricultural crops from the farm to the consumer. It also encompasses such activities as food safety, environmental and nutritional issues and energy considerations related to agricultural crops.

In your invitation to testify today, you requested I address two issues from the viewpoint of a food processor. First, the role and capacity of the food processing industry to conduct research aimed at increasing long-term productivity. Secondly, the role of the food processing industry in establishing future long-term national research goals for food and agriculture.

My views and comments this afternoon on these issues are the result of my experience during the last 13 years as Director of Research and Development for Ocean Spray, and earlier experience with Dupont Chemical Company, where I was engaged in the commercial development of agricultural chemicals. During the last dozen years I have been a member of the Technical Committee of the Grocery Manufacturers of America and the National Food Processors Association, which are major trade associations representing the food industry. These technical groups have an active interest in the future of post-harvest technology. More recently, I was a member of the Advisory Panel to the Office of Technology Assessment's review of the status of the United States Food and Agricultural Research System.

The role and capacity of the food processing industry to support basic and long-term research in post-harvest technology is often misunderstood by those not familiar with our industry.

As the Committee is aware, the food processing industry is a highly competitive and price sensitive industry. Ours is not a technology driven industry in comparison with the drug, chemical or electronics industries. The financial structure of the food industry does not allow a proportionately large investment for research activity when compared to other industries. It is very difficult, due to the traditional nature of our products, for one company to benefit significantly from direct investment in basic research. Our industry's successes with technology have come through applied product and process research. Historically, we have been dependent on sources outside the industry for basic research in science and engineering.

The marketing and financial structure of our industry, as well as the historical sources of our new technology, has had a marked effect on the organization and direction of our technical activities. The technical resources of a majority of food companies are used primarily in the following applied areas: New product development, modifying and reformulating existing products, solving quality related problems, packaging changes, process development, and Government regulatory issues.

We do not conduct and are not equipped to undertake basic research aimed at increasing fundamental knowledge in science and engineering on which advancements in post-harvest technology will come. It is unlikely, in my opinion, that the industry, given its present structure and resources, will change its current research orientation.

Even within the total agribusiness industry, the rate of investment for research and development in the food industry is less than other segments of agribusiness. The animal drug industry allots approximately 12 percent of their total sales dollars to research; the pesticide industry, 10 percent; the farm machinery industry, 3 percent; the fertilizer industry, less than 1 percent. The food processing industry allots less than 0.5 percent of their sales dollars to research and development. The average figure for research and development for all types of industry in the United States is approximately 3 percent of total sales dollars.

In November 1981, Food Processing magazine published the results of a survey of the 100 largest food processing companies in the United States. These companies range in annual sales from $300 million to several billion dollars. This group was asked the extent of their research and development budget. Among this group, 58 companies reported spending under one half of one percent of total sales dollars on research, 32 companies report spending in the range of one half to one percent, and the remaining 10 companies spend in the range of one to one and a half percent of total sales on research. It is apparent to those familiar with the industry's technical resources and abilities that only a very small number of companies have the appropriate staff, facilities or budget to engage in any type of research that could be considered basic or long-term in nature.

Historically, the food processing industry has obtained its new science and technology mainly from two sources. First, the laboratories and pilot plants of USDA, state agricultural experiment stations and university food science departments. Secondly, a major source of new technology is our suppliers of ingredients and processing and packaging equipment. There is strong evidence that our ingredient and equipment suppliers are, in turn, also dependent on basic research conducted in the same federal, state and university laboratories.

In the past, the technology we received from our ingredient and equipment suppliers has been mainly from American companies. There is some question if this will continue to be the case in the future.

In the past, the technology we received from our ingredient and equipment suppliers has been mainly from American companies. There is some question if this will continue to be the case in the future.

In the previously mentioned survey conducted by *Food Processing*, the research management of the 100 largest American food companies were asked the following question with regard to post-harvesting technology, "How do you rate the level of R&D being carried out in the United States, Europe, and Japan?". This is a summary of their reply with the No. 1 rankings shown in the table.

	Percent		
	Europe	Japan	United States
A. New product development	12	18	70
B. Packages/packaging	56	23	21
C. New process development	32	30	38

This limited survey indicates, as we might expect, that we maintain an edge in new food product development. However, this group ranked European research and development in the area of packaging superior to the United States by a margin of more than 2 to 1. At the present time in the area of new process development the United States is approximately equal to European and Japanese efforts. This survey suggests that in the future American manufacturers may have additional competition in their efforts to supply the food industry with processing and packaging equipment.

In my own company, approximately 5 years ago we became concerned about the rising cost of packaging for our products. We began to explore alternate containers to our traditional cans and glass. After an extensive survey, we felt that alternate packaging systems were not available in this country; and we sought alternatives in Europe. The result of this commercial development effort was the introduction early in the summer of 1981 of our products in flexible containers, which we termed the "Paper Bottle".

Ocean Spray's capital investment to date in processing and packaging equipment for these new packages has been in excess of $12 million. We expect by 1986 to

invest a total of $25 million to $35 million in new equipment to manufacture "Paper Bottles". The majority of this equipment will be from foreign manufacturers.

Finally, a few comments on the role that the food processing industry can play in assisting in the establishment of long-term research goals.

Technical groups in the food industry should continue and expand their role in helping to identify areas that require development of new basic knowledge in science and engineering that will have significant benefit to the food processing industry. We should also be users, testers and adapters of the scientific results from federal, state and university laboratories. There is distinct room for improvement in the quality of advice and counsel that the food industry currently offers to USDA.

In recent years, the interaction between the food industry and the USDA research segment has been affected by doubt about the firm committment on a national level to the importance of research on post-harvest technology by USDA.

Industry committees, representing major commodities, could play an important part in helping to reestablish this interaction and to assist in establishing suitable long-term research goals and objectives for USDA research.

As a member of the Advisory to the Office of Technology Assessment, which recently completed its study of the food and agricultural research system, it is quite obvious that improvements can be made in all phases of the USDA research organization. This includes the management of research, the manner in which research objectives and goals are identified, how research is conducted and these results disseminated. I believe there is a general sentiment in the food industry that much can be done to improve the caliber of post-harvest technology research in USDA laboratories.

Since 1972, a series of studies have been completed on the capability of the USDA research organization and its laboratories. These studies, including the latest by the Office of Technology Assessment, suggests a variety of options to improve the USDA research system. Unfortunately over a ten year period, little progress has been made in improving USDA research.

Mr. SCHEUER. All right. Now, we will hear from you, Dr. Wilcke.

Mr. WILCKE. Thank you, Mr. Chairman.

I am also representing the Agricultural Research Institute here today.

Mr. SCHEUER. Very good.

Mr. WILCKE. Since the terms agriculture, and particularly the agricultural, industry, mean different things to different people, I think we should start with a clarification of which segments of the industry we are addressing today, and starting with the very basic part of the industry, the farm operator, the research capability is very limited. He will make comparisons of different varieties of seeds, and different cultural practices, and so on, but this information is for his own use, and so not published, but the farm operator does participate in research to the extent that we have certain checkoff programs which are used for funding research in addition to the promotional efforts which are usuallly the primary objective of checkoff systems.

In the next category, it might be the small supplier such as the local retailer who provides the services and the commodities, who probably has no research capability.

Then there would be the small manufacturer who provides specialized equipment or products which have a very limited demand, and this is one that is frequently neglected. This group is usually more concerned with innovation and patents than it is with research.

They can be very vital to specific small operations, and Jim has mentioned some of these, but if you look at the companies that are supplying the equipment to utilize infrared technology, which is becoming important in agriculture, or the peanut industry, where the suppliers of the equipment are very small, or the sheep and wool

industry, or even the tomato picking machine that has been the subject of much discussion, we are looking at segments of agriculture that are often not considered when we are thinking of agriculture overall, and the economists quite often ignore them, but yet I think a decision that has to be made is not the size of these industries, but their importance to our overall economy.

Then we can move to the organizations representing various areas of agriculture; the cooperatives, the farm organizations, such as the Farm Bureau, Farmers Union, and so on, which are not primarily research oriented, but they are involved in research.

There are also commodity groups representing almost every major agricultural commodity, and these are, for the most part, research oriented. They provide both funding and performance of research, and they are invaluable resources for the identification of agricultural problems, and in assessing their importance and priorities.

Now, finally, then, there is a large group of supporting industries which, in reality, constitutes the group that is usually identified when we are talking about industry's participation in research programs, because they are the people that have the resources. These include plant and animal breeders, machinery manufacturers, divisions of chemical companies producing products needed to preserve or modify our agricultural products, and a long list of other supportive businesses which are very active in research programs.

The amount of funding provided by the different groups is pretty well documented for the public sector, but there is less precise information on the expenditures for research in the private sector.

We have made two attempts at the Agricultural Research Institute, first in 1965 and then attempted to update the information in 1975 and 1976 to get at the question of just how much industry does contribute to the research programs, how they invest their resources, and how they contribute to overall agricultural research programs.

Ruttan has addressed this question. So has the National Science Foundation.

Industry invests almost as much as the Federal Government, the Agricultural Research Service—and the State agricultural experiment stations combined annually; that is, if we include both research and product development.

It is hard to get an exact figure because again concepts that constitute research vary from group to group. It is estimated to be more than $1 billion annually from the private industry.

The type of research conducted by the private industry—and Jim said a little about this—was addressed in the ARI surveys.

At the time of the first survey, which was the most satisfactory, approximately 9 percent of the research funding in the private sector was devoted to basic research, 50 percent for applied research, and 41 percent for engineering and development.

Research expenditures appear to be concentrated in three areas. First is for protection—to provide information necessary to comply with regulations and improve products for competitive reasons; second, efficient production; and third, product development and processing.

These three areas made up 87 percent of the total investment of the private sector.

We come to the question of who should be doing what, and that is a very fuzzy question again.

The determination of the research for which the private sector should assume primary responsibility is one that is under question now. We have looked at it and have arrived at the conclusion that there is probably no sharp line of distinction there; that it has to be done on the basis of particular problems involved.

There must be a determination of why research programs are really needed, and who will be the primary beneficiary of the results of successful research programs. When industry has an opportunity for return on their investment, they will conduct research to address problems concerning specific lines of work.

There is also an anomaly in the policy of encouraging industry to assume responsibility for broader research areas, when at the same time, there is skepticism and reluctance to accept the findings of research conducted by industry because of suspicion of bias and lack of objectivity.

It should be obvious that industry, which has to live on the success of its products, has the greatest stake in interpreting the results with the greatest objectivity.

Therefore, if the agriculture industry is to be effective in increasing its role in providing the basic information and technology which will be required, their research must be accepted with the same degree of credibility accorded the results of their peers in the public sector.

It may be surprising to some to note that industry does not always accept the results from the public sector. Verification is often necessary before the risk of application of new research findings can be justified.

We have been negligent in not taking full advantage of the contributions industry has made to the research programs. They should be integrated more thoroughly than they have.

We feel that now we have a practical and workable system which can be developed, and is in the process now whereby the information available to industry can be tapped better than it has been, and also that collaborative efforts can be established in solving certain problems of general interest.

There is a committee of the Industrial Research Institute, which has been working with the ARS people in planning who will assume primary responsibility in such areas as growth regulator research. This group is also in support of education for more scientists, which was a little surprising to me, but that was one of their first objectives. The Agricultural Research Institute has a program set up which is not operative yet, but which is in the hands of ARS now, where they would recruit certain scientists knowledgeable in the field, small groups, to review programs and projects with the ARS, as needed.

We think that can work, because it is small groups.

Just a couple of areas that we think need attention: It would not be complete without mentioning genetic engineering. We think this is a very promising tool. Industry is cooperating and participating to a very great extent in this particular area and will probably in-

crease its participation in the future, but, again, this technique must be kept in perspective as being one of many avenues of approach to our problems.

It must also be recognized, and it has been stated very recently by some of the leaders in this field, that we should not expect any real progress to be appearing in our plant and animal results for some 15 to 20 years. It is not a quick-payoff-type thing. The complex structure of plants and still more complex structure of animals presents certain problems which are now becoming apparent. They will be solved, but it will take time.

This is a spectacular area of research, but, again, it has demonstrated the necessity of keeping a balanced approach to our overall programs to avoid fadism.

We must take full advantage of new concepts without diminishing our attention to other equally important methods of solving our problems.

Jim has discussed the post—harvest area. This is one that we are interested in, and particularly in determining what the cause of the loss—which has been estimated to be between 20 and 25 percent in some of our food products—before it reaches the consumer, and it just seems incredible that we would make the expenditures in terms of cost and manpower and resources to produce food and fiber and make no real effort to reduce those losses.

In summary, then, Mr. Chairman, progress can be made most effectively, of course, if we get the different actors working together with mutual respect and mutual trust in their results.

We have had too many studies of the agricultural research system. We have had much criticism from both knowledgeable critics but also from some who are totally unfamiliar with agricultural problems and techniques for solving those problems.

It does seem that now would be the time to build on the strengths of the organization, and certainly it has strengths, and to correct what deficiencies there are in an orderly manner instead of approaching them with an ax.

Industry will assume a more active role in providing needed information and technology if: First, research results obtained by industry and the public sector are accorded mutual respect and credibility; second, if industry is represented more adequately in the research planning process with more open discussions on integration of public and private research.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Wilcke follows:]

Statement Of

HAROLD L. WILCKE, PhD

Ralston Purina Company
Agricultural Research Institute
Before the Committee On
Natural Resources, Agricultural Research and Environment
Of the House Committee on Science and Technology

July 29, 1982

Mr. Chairman and Members of the Subcommittee: It is a privilege and an honor to present our thoughts on the role and capacity of private industry to support research projects necessary to resolve both short and long term agricultural productivity, preservation, transportation, and delivery systems and to examine the role of private industry in establishing measurable research goals and some degree of priority for those goals.

The agricultural research system in the United States which has discovered, developed and applied new innovations and technologies in all facets of our agricultural system, includes both public and private sector contributors. Among the major publicly supported agricultural research agencies are the Agricultural Research Service of the United States Department of Agriculture, Land Grand Universities and Agricultural Experiment Stations in every state, plus the 1890 Institutions and Tuskeegee, and non-Land Grant Universities which make important contributions to agricultural science, both directly and indirectly. Private foundations are also valuable resources.

The private sector contributions also originate from multiple sources including plant and animal breeders, the fertilizer industry, animal feed manufacturers, divisions of chemical companies producing products used in production, preservation, and modifying agricultural products, animal health industries, human food processors and distributors, machinery companies, farm building and equipment suppliers, and others engaged in packaging, preservation, processing, transportation, and distribution of agricultural and food products. Thus, it is apparent that the agricultural system is diverse, complex, and vital.

11-864 O - 83 - 21

The financial contributions of the public sector are documented quite accurately, but there is less precise information on expenditures for research in the private sector. Surveys made by the Agricultural Research Institute (1965, 1975-76), by Ruttan, and by the National Science Foundation indicate that private industry expenditures for research and product development are approximately equal to the total expenditures of the US Department of Agriculture (ARS) and the State Agricultural Experiment Stations combined. (The most recent estimates of private sector expenditures for agricultural research have been somewhat in excess of $1 billion annually.)

Therefore, it is obvious that any consideration of the role of any one of the three primary actors (ARS, SAES, private industry), must include the roles of all three. Further, in the delivery systems for the transfer of technology from research to users, the Agricultural Extension Services and the Information Services of both USDA and the States and the private sector must be utilized effectively and efficiently and coordinated to the highest degree possible.

Any consideration of the role of private industry obviously must begin with a clarification of the general segments of the industry we are addressing. Starting with the very basic part of industry, the farmers themselves, the research capability is probably limited to such things as the comparison of different varieties of seed, different strains of animals, or demonstrations of recommended practices. Such trials, of course, would be for the individual's own information, and would usually not be in the nature of very well controlled experiments.

The next category might be the small supplier such as the local retailer who provides the feed, seed, fertilizer, essential services, and so on, and who probably has no research capability.

Then there would be the small manufacturer who provides specialized equipment or products which have a very limited demand. This group would probably be more concerned with innovation and patents than with research. This group can be very vital to specific areas of the agricultural industry which are

small in volume but which are essential to our economy. As examples of this type of business we might include the suppliers of instrumentation for infra-red technology which is becoming an important tool in agriculture; we might include the suppliers for the sheep and wool tool industry which is a relatively small industry; such industries as small vegetable harvesting equipment which would be small in total volume; and possibly even the maligned tomato harvesting machines. The resources of such a group for research would be very limited, and the question then becomes whether the survival of such industries and commodities are vital to the economy of the country. This is a question that is frequently not addressed by our economists, but it is an important, though perhaps minor part, of the consideration of the publically supported programs.

Then there are the large number of organizations representing different agricultural interests: the cooperatives; the farm organizations such as Farm Bureau, Farmer's Union, NFO, American Agricultural Movement, which are not primarily research oriented; but there are also commodity groups representing almost every major agricultural commodity which are research oriented and which do contribute to the funding and performance of research programs. These groups are invaluable as sources of expertise in identifying agricultural problems and in assessing priorities.

Finally, there is the large group of supporting industries, which in reality constitutes a group that is usually identified under consideration when the private sector's contribution to research programs are considered. Many attempts have been made to devise criteria for the types of research projects which should be the particular responsibility of the agricultural industry. None have been satisfactory because of the diversity of interests among this group and their own criteria for the expenditure of their available resources.

It is of interest to note the type of research conducted by the private industry as surveyed by the Agricultural Research Institute. At the time of that survey, approximately 9% of the research funding in the private sector was devoted to basic research, 50% for applied research, and 41% for engineering and development. The research expenditures appear to be concentrated in three areas: protection, that is to provide the information

necessary to comply with regulation and to improve products for competitive reasons - 10%; efficient production; and product development and processing. These three areas account for 87% of the total annual research expenditures by the group which responded to the survey.

The definition of basic research used in this study is the acquisition of knowledge to understand and explain the basis for the results that are desired or observed. Examples of this are the research that is done to determine the effects of growth regulators at various stages of the plant life or at various concentrations of the regulator applied to the plant, or the basis for the growth stimulating effects of low level antibiotics when fed to animals, and similar types of projects. In other words, it is what is commonly described as mission-oriented basic research. It does not conform to the definition so aptly proposed by a distinguished member of this House who defined basic research as that which is done for the amazement of the scientist. In agriculture there is no sharp demarkation between basic and applied research. Our research must be directed toward real problems and opportunities.

With increasing demands on public funding of programs of continually broadened scope, there must be, and has been, an intensification of the consideration of the role of the private sector in assuming responsibility for various areas of research. This is as it should be, but it must be done with consideration for the real need for problems to be resolved.

There must be a determination of why research programs are needed and who will be the primary beneficiary of the results of successful research programs. But there is also an anomaly in the policy of encouraging industry to assume responsibility for broader research areas, while at the same time there is skepticism and reluctance to accept the findings of research conducted by industry because of suspicion,of bias or lack of objectivity. It should be obvious that industry scientists, whose careers and integrity of their research results and the information they supply based upon research, are judged by the performance and acceptance of the resulting programs and products. Therefore, if the agricultural industry is to be effective in increasing its role in providing the basic information and technology which will be required, industry research must be accepted with the same degree

of credibility accorded to the results obtained by their peers who happen to be employed in the public sector. It may be surprising to some to note that quite frequently industry requires verification of research results published by the public sector scientists, and would expect active cooperation from the public sector in verifying their results.

In general, the private sector will perform the research which has a promise of yielding some financial return. This is the very nature of business and must be a guiding principle for the investment of funds for which the business is responsible. However, it is obvious that there are areas of research which may seem marignal but which industry, with the proper understanding, could be induced to assume. Very little of this can be accomplished on an adversary basis as has been the case at some times in the past.

We have been negligent in not taking full advantage of the contributions industry has made to our research programs. Because of the very nature of their business, industry will not divulge or publicize all of the areas of research in which they are interested or perhaps not always the results that are obtained. However, we feel that a practical and workable system can be worked out whereby information available to industry can be tapped and also that collaborative efforts can be established in solving certain of the problems that are of general interest. We feel this can be accomplished by more active participation by the private sector in the planning process for the public research systems. There has been no reluctance on the part of the US Department of Agriculture and the State Agricultural Experiment Stations to this concept, but we feel that now we have a mechanism whereby it can be accomplished more effectively. In the past we have had just token representation from industry on the planning committees. Because of the diversity of the agricultural business, this is not effective.

The system we are proposing would involve organizations such as the Agriucultural Research Institute and the Industrial Research Institute. Because of the fact that they represent practically all of the industrial research in this country, they could act as focal points to identify scientists with specific expertise, both within and outside their organizations.

We believe that small groups of these scientists can be persuaded to provide the necessary time and effort to evaluate research programs and to help arrive at priorities. This need not be cumbersome because a small group would be assigned to the areas of interest and only those with specific expertise in that discipline or commodity would be involved. This would provide a broader, more unified and more authoritative support for research proposals as they proceed through the budget process. This is a concept that is being tested in a small way at the present time but we feel that it should be recognized and expanded.

It is not our purpose here to attempt to identify all of the areas of research we feel will be important in the long range planning of opportunities in agriculture. However, there are areas in which cooperation between industry and publically funded programs are of particular interest.

First, the area that is receiving the most attention at the present time is that of genetic engineering. This is a very promising tool to be used in attempting to increase the productivity of our plants and animals. This is an area where both industry and the public sector are cooperating and participating to a very great extent, and industry will probably increase its participation in the future. However, this technique should be kept in perspective as being one of many avenues of approach to our problems. It must also be recognized that it has been stated by some of the leaders in this field that we should not expect any real progress to be appearing in our plant and animal results for some 15 to 20 years. The complex structure of plants and still more complex structure of animals presents certain problems which are now becoming apparent and which will be solved over a period of time, but will require much greater effort than that required by the single cell organisms which have provided the basis for the demonstration of the principles. This spectacular area of research again has demonstrated the necessity of keeping a balanced approach to our overall problems, and to avoid faddism. We must take full advantage of new concepts without diminishing our attention to other equally important problems.

Another area of mutual interest is that of post-harvest technology. This includes everything from the time of harvesting until the food reaches the

consumer or the other products are applied to their final uses. One area that has been neglected and will probably not be done unless it is supported by public funding is that of determining the extent of our losses in both quantity and quality of food from the time of production to the time of consumption. Some studies have been made which indicate that as much as 20-25% of certain of our foods are lost after they are produced and before they reach the consumer. The causes for these losses have not been really identified. It seems incredible that we would make the expenditures in terms of cost in manpower and resources to produce food and fiber and make no real effort to reduce these losses.

Much progress has been made in the processing of food preservation of both quality and nutrient content, and this will continue, but we must have more participation from the public sector in identification of the source and causes of loss.

If we are to be innovative in developing other processes and other types of products, we must know more about the basic chemistry, biochemistry, and physical properties of the constituents of our raw food products. Basic chemical reactions such as those described by Feeney and Whitaker for protein modification must be evaluated from the standpoint of safety or lack of toxicity. The real value and utility of the end products must be established. These types of reactions may be used in restructuring some of our raw products for export.

Agriculture has contributed most significantly to our export dollar, but we should be capitalizing on the many opportunities to provide added value to our raw products instead of exporting them simply as commodities. Processing of commodities before exporting provides additional employment, and permits the use of certain components of the commodity to meet specialized requirements, while adapting the remaining fractions to other uses, thus increasing the efficiency of use, and obtaining maximum value for the whole product.

If we are to develop our export market sales, as our Secretary of Agriculture has stated to be one of our objectives, we must know more about the total markets that we are able to penetrate. We need an assessment of the place of innovative products in the export markets on a comprehensive basis such as some of our competitors in the export markets have been doing. This should be a joint effort between the public sector and the private businesses in order to bring the expertise of both to develop a balanced and comprehensive program which will be beneficial to our entire economy and not be limited to individual segments.

We need to learn how to control the maturation of our perishable fruits and vegetables in order to produce products with more uniform maturity and to control senesence in the product. This is very basic work, much of which is being provided by the private sector at the present time, but which will also be much more productive if we have the cooperative effort of both the public and private sectors.

In summary, much more will be accomplished in solving the need for increased productivity, better preservation and processing of foods and feeds with less loss of nutrients and of volume, when we have both the public and private segments attempting to cooperate with each other with mutual respect. We have had a plethora of studies of the agricultural research system. We have had criticisms and suggestions of change by many who are not familiar with agriculture or its problems. It seems it is now time to build on the strengths of an organization that has produced the most effective results of any we have in this country and to emphasize those strengths while at the same time to correct any deficiencies in an orderly manner. Industry will assume a more active role in providing needed information and technology if:

a) Research results obtained by industry and the public sector are accorded mutual respect and credibility.

b) Industry is represented more adequately in the research planning process, with more open discussions on the integration of public and private research.

References

Wilcke, H. L., and H. B. Sprague, Agricultural Research and Development by the Private Sector of the United States, Agricultural Research Institute, Washington, D. C., 1965.

Wilcke, H. L., and J. L. Williamson, A Survey of U.S. Agricultural Research by Private Industry, Agricultural Research Institute, Washington, D. C., 1975-1976.

Ruttan, Vernon W., The Private Sector in Agriculture Research, presented at Annual Meeting of the Agricultural Research Institute, St. Louis, MO, October 15, 1980, ARI Proceedings, pp 80-97.

Feeney, Robert E., and John R. Whitaker, Food Proteins Improvement through Chemical and Enzymatic Modification. Advances in Chemistry Series No. 160. American Chemical Society, 1977.

Mr. SCHEUER. Can you tell me how a tomato-picking machine can tell whether that plant is red and ready for the picking, or is green?

Mr. WILCKE. That is one of the reasons why in this total paper, that I have said that we need some uniformity in the maturation process. The fruit and vegetables deteriorate after they are harvested and we need to know more about the physiology of senescence.

Mr. SCHEUER. What?

Mr. WILCKE. The aging of the product and deterioration after. Part of that is being investigated now through growth regulators, and I think our biggest hope in getting this is through the growth regulators.

Mr. SCHEUER. Tomatoes and corn have a marvelous taste when picked right out of the ground, but once they have been picked, and a few days have gone by, they have a totally different taste. If there is anything in the offing in the way of agricultural research that is going to preserve that initial wonderful taste right when the tomato is off the vine, or the corn is off the stalk?

Mr. WILCKE. Two avenues of approach: One is through the much-discussed field of genetic engineering, and the other is a program that I have suggested here that we need—that we do not have now—and that is a thorough study of the chemical, biochemical, and physical characteristics of these fruits and vegetables so that something can be done to control the processes that affect these characteristics.

Mr. SCHEUER. Dr. Tillotson, you participated in the OTA assessment of the USDA research organization, and they identified certain changes in the footnotes of that report. What kind of substantive improvements in USDA's research and delivery capability would be achieved through the changes that were identified in the footnotes?

Mr. TILLOTSON. I guess those took place in June 1981, so it is too early to tell, I guess; but, I would like to make some comments on this. I look at the situation as industrial researcher, and I see a system that shows some serious deterioration.

Research is a young person's game. A system has to have a constant supply of new people coming in that are bright, creative, trained in new disciplines, and well managed.

What I see today is the result of poor research management and an inability to attract bright people and eliminate people that should go into other areas.

In industry, we have an advantage. You first go into the research end. If you are not a researcher, then you are transferred to quality control or manufacturing.

Unfortunately, I don't think the Government has that option. Every place I have ever been, it is the bright people coming into the system who constantly move forward. But more than that, you need good research management, so that research can be properly controlled and run. Many of the things we are seeing today are examples of poor research management.

The Congress should be given options of what could be done. In industry, all the time, we cover our management—tell them these are the options. It is a pathetic thing that we are at this stage. It is a system that is ingrown and does not benefit me at all.

11-864 O - 83 - 22

Mr. SCHEUER. When you talk about the system, are you talking about the Federal presence?

Mr. TILLOTSON. Yes, the system has gotten old. There is a shortage of money; additionally, you need bright young people. You have to have these people coming in and pushing knowledge along, and that is not there.

Mr. SCHEUER. That is not happening today?

Mr. TILLOTSON. You also don't have the bright leaders that you need. You have administrators.

I disagree with most of the agribusiness club; that agricultural research is that much different than others. There are plenty of companies that run very complex organizational structures in the chemical and pharmaceutical industries. They have many demands, and everything else. We just do not have modern research management in this system.

Mr. SCHEUER. How do you think USDA can attract some of these bright young scientists?

Mr. TILLOTSON. It has to be an exciting place to work. There has to be good leaders, and opportunity.

I was attracted to DuPont just for that reason. There was good management and interesting things to do. I understand industrial research, and you got to have people to drive a system, and you have got to have good managers. I don't think the Government has got them.

You are going to hold hearings. Congress has done it for 10 years. You will be back here 10 years from now because the agricultural research bureaucracy should be giving you a plan; they should be saying these are the options, Congress, do you want to do this or that? A checklist—developed with industry input—ought to be presented.

Mr. SCHEUER. Does USDA reach out to industry to get their involvement and their contributions?

Mr. TILLOTSON. I have been involved in some efforts. Maybe we are not doing our job.

Mr. SCHEUER. Well, I will say I was not impressed with the figures that you gave as the percentage of cash flow in these companies that go to research. I am a graduate of the Harvard Business School more years back than I care to think about, but even at that time, industrial companies were devoting 10 to 15 percent of their gross revenues to research, and I suspect that they are doing that or better now—the successful ones.

Mr. TILLOTSON. It is industry nature. The managements may not understand the importance of long-term research; I grant that.

Mr. SCHEUER. Except that you are not talking about mom-and-pop stores. You are talking about companies that are large, as I recall your testimony.

People at those levels of management ought to understand the indispensable minimum levels of R&D that are required to keep a company on the sharp edge of competitiveness.

Mr. TILLOTSON. You have a strong point there. The figures that I have seen show that research and development—I saw a limited study of major food companies—is approximately 17 percent of total profits.

In the chemical and certain high technology industries, the chief executive officers have an extensive appreciation of technology and how to develop it. You may not always find that in the food industry.

Now, I am fortunate. My president is an engineer. It is obvious that he would have a part in this. He was part of a vision. He said we needed other things, and he sent us to Europe.

My other peers may not have that same advantage. Their chief executive officers may not understand the opportunity of new technology.

Mr. SCHEUER. When your boss sent you to Europe, you obviously did very well. These are delicious products and packed very well. I would like to have a whole case of these to put in my refrigerator; they would use the space very intelligently since they are not round.

Mr. TILLOTSON. They save around 40 percent of weight and space. They are used throughout the world. We are really one of the last countries in the world to have it.

Mr. SCHEUER. You did very, very well.

You state that developments of this kind could cause a considerable movement on the part of the American food industry to seek technology and equipment abroad.

This would mean a loss, I take it, to American manufacturers. If it would, what kind of R&D effort by the American harvest industry would be appropriate for it to play a little catchup ball?

Mr. TILLOTSON. Well, I think I have told you.

Mr. SCHEUER. From the point of view of international competition, might we say: Well, let those foreign companies do this, and we will do something else that we are very talented at, and well equipped to do?

Mr. TILLOTSON. All of these advancements rest on a basic fund of knowledge and science and technology.

I think organizations such as USDA have got to get into the basic support knowledge to move our industries ahead—that means or requires recruiting good people.

Cranberries happen to be one of the few native fruits. My pressers are German. The processing equipment comes from England or Sweden. My new packaging equipment either comes from Sweden or from Germany. Other equipment down the line comes from Italy.

Mr. SCHEUER. What kind of equipment comes from Italy?

Mr. TILLOTSON. Overwrap; secondary packaging.

The sweetener system I use, the initial patents were Japanese. I am looking at other——

Mr. SCHEUER. Is that a sugar product?

Mr. TILLOTSON. A corn sugar.

Mr. SCHEUER. If I should stay off of sugar, should I stay off of this?

Mr. TILLOTSON. It might be well to avoid it.

Mr. SCHEUER. I was sorry to read that.

Mr. TILLOTSON. There are some other things coming along that may help that.

Congress, for years, has had hearings on saccharin, one after another. How many hearings have they had on why we don't develop better technology to develop better synthetic sweeteners?

I worked in the chemical industry on substitutes for saccharin and cyclamate. We ran up against problems, a lack of methods to screen new candidates; there is a lot of basic technology that is needed that would not be proper for an industry.

The basic theory and methods to get at it might be in Government labs. It has to take—it is going to take—an amazing dedication to turn this system around.

Mr. SCHEUER. Well, when I look at the level of funding for USDA, it seems that at anything like that level of funding, USDA would be transparently incapable of meeting the needs for the research of the order of magnitude that you are talking about.

Mr. TILLOTSON. Yes, but you can't just pump money in. Money won't buy results if you don't have proper organization and the people.

First, you have to solve the organizational problems.

Mr. SCHEUER. You are talking about organizational problems in the USDA?

Mr. TILLOTSON. You are going to have to bring in people from outside, because this is an ingrown organization. I don't think any reorganization or anything elselike that is sufficient—they are in a technical army, in disarray.

You are going to have to come in and quiet the troops down, and put in a proper management and get the funds to recruit it. It is a common thing in industry.

You see companies, they need new innovation; they bring in a new group.

Mr. SCHEUER. They bring in a couple of dynamic guys.

Mr. WILCKE. One of the reasons that is underlying this, I am sure, is that personnel ceilings have been on the department for quite a number of years.

The average age of the scientists in the Agricultural Research Service now is probably over 50 years, and this can't be corrected until we get rid of personnel ceilings.

Mr. SCHEUER. Off the record.

[Discussion off the record.]

Mr. SCHEUER. Back on the record.

Mr. WILCKE. Then the other point, of course, is the pressure that has been put on the department over there to get out of some of these areas and to let industry do them. Unfortunately, this is being done without consulting industry very much to find out how much they will pick up.

It could be done on that basis very readily if our executive branch would do it.

Mr. SCHEUER. If the executive branch would consult?

Mr. WILCKE. Consult with industry.

Mr. SCHEUER. Apparently there is a feeling in this administration that Government should step out of most R&D areas.

In the area of environment, we have had the same problem with EPA.

We have had firms tell us—firms who are in the business of making all kinds of antipollution devices—that they want the Gov-

ernment to be doing the basic research. The firms say they are not equipped to do it; and, frankly, there is very little likelihood that they will do it. They said they wanted EPA and the Government to provide the basic raw scientific data to enable them to get on to applied research.

Yet this administration seems insistent on getting out of the basic research business, even though the testimony seems undisputed that industry has no intention of picking it up.

Do we have a comparable situation in your industry?

Mr. WILCKE. Yes; I think it is a question of just how important this kind of thing is, because industry is not going to pick it up just because government gets out of it, unless they have a financial incentive to do it.

Mr. SCHEUER. They won't do that kind of basic research, because too frequently, they don't see a sufficient financial incentive.

Mr. WILCKE. That is right.

Mr. SCHEUER. Well, this has been a very interesting panel. We have had two extraordinarily interesting panels today.

It is 4:30 in the afternoon, you have had a long day, and you have been very generous and very patient with us. We thoroughly enjoyed your testimony, and we thank you very, very much.

We will readjourn the hearings.

[Whereupon, at 4:30 p.m., the subcommittee adjourned, to reconvene subject to the call of the Chair.]

APPENDIX

Questions and Answers Submitted for the Record

Questions for Dr. Terry B. Kinney

AGRICULTURAL RESEARCH SERVICE AND NATIONAL GOALS

1. On page 4 of your testimony you state that, ". . . ARS addresses problems that are of national concern . . ."

A. How does the Agricultural Research Service (ARS) determine which national problems will be addressed? How is the priority determined?

B. How does ARS follow through with these research projects to determine that they accomplish the goal they are designed to? How is the success measured or evaluated?

AGRICULTURAL RESEARCH SERVICE AND INTERNATIONAL ACTIVITIES

2. On page 6 of your statement you state, "ARS also maintains international activities to utilize the talents of foreign scientists and laboratores."

A. Are these international programs directed toward helping the developing countries become self-sufficient in food production?

B. We will hear testimony from the land-grant universities of their involvement in international activities, does the ARS cooperate with the universities in this program? Does it utilize the full potential of the 1890 universities?

NATIONAL RESEARCH EFFORT

3. On page 7 you state, "A current example of effort on a national problem is the National Atmospheric Deposition Program. . . ."

A. Would you indicate some of the findings of USDA on the impact of acid rain on agriculture?

B. Are there other examples of similar national problem solving research that USDA is involved in? If so, would you provide us with a list of these efforts and a summary of the activities of each?

FUNDING FOR BASIC RESEARCH GRANTS

4. On page 8 you state that the program of competitive research grants for basic research was funded at a level of $15 million in 1978 and it has grown to level of only $16.3 million in 1982.

A. What is the reason for the slow growth in this program that funds basic science research? Is there a lack of interest by the universities or are the funds not requested by USDA?

B. Does the Agency have any plans to increase funding for basic research both for now and for the long-term? If so, please describe these plans.

NATIONAL AGRICULTURE RESEARCH GOALS

5. On page 10 you list the six national research goals. One of these goals is to, "maintain and increase the producivity and quality of crop plants."

A. What mechanism do you use to measure the success of achieving these goals?

B. In the list of goals, how do you priortize them? What mechanism do you use?

C. What mechanism do you use to insure that the USDA funds research projects designed to fulfill these goals before funding other projects?

D. What oversight does USDA employee to insure that these national goals are being addressed in research efforts?

AGRICULTURE RESEARCH CHANGES

6. On page 11 you highlight the changes in the USDA mechanisms that aid in national research planning and coordination.

A. Can you give specific examples where each of these mechanisms have influenced UDSA research policy on a national basis?

B. Has USDA been able to measure the changes in research results as a direct consequence of these major changes in USDA research policy?

C. Do additional changes need to be made in order to insure effective long-term research goals are established and met?

AGRICULTURAL RESEARCH SERVICE AND NATIONAL GOALS

1. On page 4 of your testimony you state that, ". . . ARS addresses problems that are of national concern, . . ."

A. How does the Agricultural Research Service (ARS) determine which national problems will be addressed? How is the priority determined?

The Administrator of ARS relies on the Deputy Administrator and the National Program Staff for setting priorities. The Staff analyzes research opportunities identified by scientists, research being conducted by other organizations, and research needs identified by users and then develops recommendations. These recommendations are documented in memoranda, option papers, budget analyses, program review and evaluation summaries, and other appropriate documents. Using these recommendations and information from other sources, the Administrator establishes and articulates the priorities for the Agency.

B. How does ARS follow through with these research projects to determine that they accomplish the goal they are designed to? How is the success measured or evaluated?

The Deputy Administrator and the National Program Staff are responsible for reviewing and evaluating research progress and consistency with the intended goals. They identify areas of significant progress, major constraints to further progress, emerging research problems or opportunities, and lines of research which can be discontinued.

The National Program Staff is also responsible for reviewing and evaluating specific operating programs and the research units participating in them at least every 3 years. Line managers participate actively in these evaluations and identify the need for special reviews.

Review teams develop formal lists of findings and recommendations for implementation by line management, the scientists, or the National Program Staff.

In addition to these efforts, Area and Center Directors annually review each research unit or laboratory under their supervision.

Success is measured in terms of tangible progress toward stated goals.

AGRICULTURAL RESEARCH SERVICE AND INTERNATIONAL ACTIVITIES

2. A. Are these international programs directed toward helping the developing countries become self-sufficient in food production?

All our international programs inherently require that these scientific activities be of benefit to the United States and the cooperating foreign country. In almost all instances, such scientific cooperation increases productivity, and this, in turn, leads to self-sufficiency which is the ultimate goal. In some cases, we provide the lead in technological expertise, in other cases the foreign country provides the expertise. The results are shared and are mutually beneficial.

B. We will hear testimony from the land-grant universities of their involvement in international activities, does the ARS cooperate with the universities in this program? Does it utilize the full potential of the 1890 universities?

Specific agricultural technical problems in foreign countries are initially approached through the team concept. This requires the participation of both federal and state scientists. After the problem is clearly defined and a plan developed for its solution, the best federal, state, and foreign scientific talent from research, teaching, and extension is used to form the problem solving group. The full potential of the U.S. universities is utilized including the expertise within the 1890 institutions.

NATIONAL RESEARCH EFFORT

3. A. Would you indicate some of the findings of USDA on the impact of acid rain on agriculture?

The initial emphasis has been to establish a network that is measuring the intensity and distribution of acidic deposition in the United States to determine current

levels and follow trends. Four years of data from many locations indicate that precipitation with a considerable acidity is falling in some parts of the country. All eastern states except Florida receive precipitation with a mean annual pH between 4.0 and 4.6. Studies on crops, trees, and soils have demonstrated in the laboratory that effects from acid deposition are possible. The question still to be resolved is whether or not these effects are occuring under natural field conditions. The State agricultural experiment stations and the Department of Agriculture are working with other state and federal agencies in a coordinated effort to answer this question.

3. B. Are there other examples of similar national problem solving research that USDA is involved in? If so, would you provide us with a list of these efforts and a summary of the activities of each?

The State agricultural experiment stations, 1890 schools, and Forestry Schools are working together on many national problems. Additional selected examples of this kind of effort follow.

Virus-free tree fruit.—A national interregional program (IR-2) maintains a repository of virus-free deciduous tree fruit stocks at Moxie, Washington, from which virus-free propagation materials can be withdrawn by cooperators. A companion program of research on the detection and identification of virus diseases is helping to insure the availity of virus free stocks. The repository includes superior deciduous fruit selections from throughout the United States and Canada and the program is recognized for its high standards for virus-free materials throughout the world. Materials from the repository are widely used by researchers across the United States and are the basis for subsequent release of virus-free material to industry.

Beef cattle breeding.—In a coordinated national effort, scientists in regional research projects have conducted cooperative research to determine the most effective criteria for use in developing imporved strains of beef cattle and to develop alternative breeding systems to optimize productive efficiency.

Major contributions have been made in determining the importance of heredity for the major economic traits; evaluating the effects of heterosis and the development of appropriate crossbreeding systems; and the evaluation of diverse biological types and development of alternative systems of breeding to optimize the available genetic variation. National record of performance programs and national sire evaluation programs have been developed by industry utilizing information from these studies.

Organization and performance of U.S. food production and distribution system.—The object of this broad national program is to describe the existing organizational system for producing and distributing food products, identify the forces that are changing the system and forecast where present trends may lead, assess the performance of the system, identify the impediments to improved performance, and evaluate alternative public policies and private actions that could affect the future performance of the food system. Scientists in 16 State agricultural experiment stations and the USDA are participating in the study. The project is comprehensive, multidisciplinary in its range, far reaching in the aspects and policies investigated, and innovative as to research organization.

Virus diseases of corn.—This joint cooperative effort on the part of 14 State agricultural experiment stations is attempting to identify and characterize viruses occurring on corn and sorghum in the United States, devise and test methods for estimating losses associated with the viruses and to develop methods of reducing losses through host-plant resistance, cultural practices, vector controls and reduction of overseasoning reservoirs. Virus diseases have become limiting factors in corn and sorghum production over large areas of the corn belt and the South. Heavy emphasis is being placed on host-plant resistance. Methods of disease control which would reduce or eliminate the vector or the overwintering host are also being evaluated.

CANUSA program.—Control of three different forest insect pests collectively known as the spruce budworms is the object of this research. Approximately 20 universities are involved on population and damage evaluations, forest stand dynamics, environmental impacts, and pest management systems.

Level and patterns of living in the rural South.—This joint project under the leadership of scientists from the 1890 institutions and Tuskegee Institute involves 15 institutions located in 14 States. This multi-institutional effort will provide a complete profile of rural poverty in the South. The main issues being studied are the extent and level of poverty and income inequality in the rural South and the identification of those societal, local, and personal influences which differentiate between those individuals who escape poverty and those who do not. Policy recommendations and strategies for reduction of poverty will be generated.

Grain and oilseed marketing.—A National effort is underway to address problems and needs of marketing and delivery of quality cereals and oilseeds in both domestic

and foreign markets. The program includes identification of quality factors and equipment, procedures, and production practices to reduce quality deterioration due to processing, storage and handling throughout the marketing system. Expanding export volumes from other countries of cereal and oilseeds is making the quality of U.S. commodities more critical. Results from this program are having a significant effect on the ability of the U.S. being competitive in the world market.

Dairy cattle breeding.—Scientists from 21 States and ARS have combined their efforts under the S-49 and NC-2 regional research projects to determine how selection can be used to change cows to meet future industry needs. Long-term selection studies are being conducted to measure the direct response to selection and the correlated responses in other traits. Emphasis is being placed on developing procedures for changing the genetic makeup of dairy cattle for efficient production of milk. Selection for high milk production does not result in any major deleterious changes in other traits. Studies on abnormalities and congenital defects have helped the industry to keep the incidence of abnormalities in breeding stock at low frequencies.

Mycotoxins in feeds and foods.—This joint reearch effort deals with naturally occurring toxic fungal metabolite that exert harmful biological effects on animals and man. It involves characterization of fungi involved and environmental conditions associated with their development. It also deals with the specific mycotoxins produced, their effects and methods for their control. The total economic impact of mycotoxins remains undetermined, but there is convincing evidence that mycotoxins in the feed supply is potentially a serious problem. Results from this program are helping U.S. producers minimize their occurrence and deal with them when they do occur.

CLEARANCES OF PESTICIDES FOR MINOR AND SPECIAL USES

Through a national interregional project (IR-4), the State agricultural experiment stations and USDA are identifying minor-use needs and any data needed for clearance by regulatory agencies to make the needed chemicals available to producers. The program is based on meeting those needs for which there is insufficient incentive for private industry. Once the needed data are developed, the IR-4 program leaders prepare and submit petitions for clearances on food, feed, fiber, and ornamental commodities. The IR-4 program has for a number of years been the primary avenue for clearance of chemicals for minor uses. The program is currently being expanded to include efforts for the clearance of minor and specialty animal drugs.

POTATO GERMPLASM

A national center for the introduction, preservation, distribution, and evaluation of potato germplasm is operated through the State agricultural experiment stations' IT-1 project at Sturgeon Bay, Wisconsin. This is the primary center for potato germplasm in the United States and is a major part of the worldwide efforts to maintain and evaluate genetic resources for this important food crop.

SWINE BREEDING

Swine breeders throughout the United States have cooperated in research on swine breeding to improve the productive efficiency of swine. Significant contributions have been made in determining the importance of heterosis on reproduction and growth traits; the effectiveness of selection for traits of major economic importance; the importance of maternal effects of inheritance on the efficiency of swine production; the mode of inheritance of Porcine Stress Syndrome (PSS) and its relationship to economic traits; and the development of breeding systems. Research emphasis at present is on improving sow productivity.

SHEEP BREEDING

Cooperative efforts among various research stations in the U.S. in attacking the broad problem of increased efficiecy of sheep production have been emphasized because of the geographic differences in production and marketing systems. Current efforts are directed toward developing methods for utilizing the genetic variation among and within breeds of sheep; evaluating the use of alternative feed resources to meet nutritional needs of sheep with increased genetic potential for reproduction and protein synthesis; and development and evaluation of production management systems. Results indicate that profit from market lamb production can be increased substantially by using crossbred ewes of superior maternal breeds to produce crossbred lambs from superior meatbred sires. By using either ¼ or ½ Finn crossbred ewes, producers can increase numbers of lambs born per 100 ewes by about 20 to 50 lambs, respectively, above levels for domestic breeds or crosses.

Agricultural climatology.—Agricultural climatology needs are being addressed through four regional technical committees. These committees are developing and refining data on climate phenomena such as drought, growing degree days, rainfall, temperature, and others which are directly related to the risks involved in crop and animal production. Fruit crops in particular have benefited through this research.

Forest tree genetic improvement.—There are three regional technical committees dealing with the genetic improvement of commercially important trees. The outstanding accomplishment among these has been the improvement achieved in southern pines, primarily loblolly pine. The first improved generation is yielding at least 15 percent greater products than do unimproved comparable stands. Work is continuing on the second improved generation with expectations of a similar percentage of gain in yield.

FUNDING FOR BASIC RESEARCH GRANTS

4. A. What is the reason for the slow growth in this program that funds basic science research? Is there a lack of interest by the universities or are the funds not requested by USDA?

The rate of growth for competitive research grants program is result of tight budgets and needs of the base programs for agricultural research. Interest in the program is high. Since its beginning, the number of high quality proposals submitted has far exceeded the availability of funds. In fiscal year 1981, proposals were submitted with requests for a total of $139 million while only $15.5 million was available. The budget request for fiscal year 1983 includes an increase for the competitive research grants program of $6.56 million that would make a total program of $22.88 million.

4. B. Does the Agency have any plans to increase funding for basic research both for now and for the long-term? If so, please describe these plans.

In addition to an increase in competitive research grants, the Department of Agriculture is also taking steps to strengthen basic research efforts in its other research programs and provide increased funding for these programs of basic research.

NATIONAL AGRICULTURE RESEARCH GOALS

5. On page 10 you list the six national research goals. One of these goals is to, "maintain and increase the productivity and quality of crop plants."

A. What mechanism do you use to measure the success of achieving these goals?

The Deputy Administrator and the National Program Staff are responsible for monitoring progress toward goal achievement. Annual reports are prepared by each scientist. National Program Staff specialists review these reports and prepare annual progress reports for their areas of coverage. These summaries as well as other sources of information become the basis for evaluation.

B. In the list of goals, how do you prioritize them? What mechanism do you use?

All goals are important. Thus there is no ranking of goals. Distribution of resources among goals is determined by the Administrator. His decision is based upon recommendations of the Deputy Administrator and the National Program Staff. The manner in which the National Program Staff determines priorities was discussed earlier.

C. What mechanism do you use to insure that the USDA funds research projects designed to fulfill these goals before funding other projects?

ARS uses a formal peer review process for evaluating proposed research projects. No project can survive that system if it does not have potential for providing information needed to meet one of the six national goals. As further insurance against a slip, each new project is entered into the Current Research Information System (CRIS). Prior to entry in CRIS, the project must have the approval of line officers and the National Program Staff.

D. What oversight does USDA employ to insure that these national goals are being addressed in research efforts?

In ARS, the Deputy Administrator and the National Program Staff have responsibility for insuring that there is a reasonable balance of efforts toward the six goals. Adjustments are made annually through the budget process. Redirection of resources, independent of the budget process, are made at any time that imbalance becomes apparent.

AGRICULTURE RESEARCH CHANGES

6. A. Can you give specific examples where each of these mechanisms have influenced USDA research policy on a national basis?

It is difficult to cite specific examples of mechanisms that have influenced national policy because national policy is usually based on a number of considerations and not attributable directly to any one thing.

One of the mechanisms cited, the National Agricultural Research and Extension Users Advisory Board, has had a significant influence on national policy over the past few years, but its recommendations have been tempered by other advice. The Users Advisory Board has pushed hard for more research in the natural resources area. I believe this is partly responsible for the increased emphasis placed by the Department on natural resources use and conservation. More recently, the UAB has strongly recommended increased emphasis on production and productivity in agriculture. The Department has placed these in higher priority partly as a result of these recommendations.

The Joint Council has also had an influence on national policy in many areas. They were instrumental in designing a system for linking information systems in extension, research, and higher education in such a way that they could be aggregated and the total program described in a common language. The Joint Council has also made input into policy at the USDA level in several ways. It frequently makes policy recommendations to the Secretary and has from time to time met with him and his staff to discuss matters of policy.

B. Has USDA been able to measure the changes in research results as a direct consequence to these major changes to USDA research policy?

It is not possible at this time to quantify the results of these changes in USDA research policy because other changes have been taking place at the same time. We are continually evaluating the payoff from research, but its measurement tends to be qualitative rather than quantative.

C. Do additional changes need to be made in order to insure that effective long-term research goals are established and met?

Of course, we need to change and we need to continually reassess our priorities in light of long-term goals. This we are doing and will continue to do.

DR. HANDY WILLIAMSON

QUESTION 1-A

1. On pages 4 and 5 of your testimony, you have described the relationship of food and agriculture policies. You have called for a National Food policy and from those goals, agriculture research would be directed and refined. The committee is interested in the idea of a National Food Policy.

A. Would the goals of this policy be very broad and general or could they be readily targeted? Please give an example.

The goal for the body or the charge would be to bring to bear a larger representational point of view in the formulation of food policy. It is felt that the recommended cabinet officers would be able to help better assess the requirements and consequence of existing or proposed food policies and agricultural policies. This would lessen the likelihood of the government arriving at a food policy that balanced the interest of commodity groups, while creating difficulty in the domain of Health and Human Services or Labor, etc. The policy would be comprehensive and yet address specific policy concerns.

QUESTION 1-B

B. How would you view the addition of the Secretary of HHS to emphasize nutrition and food costs to the poor?

Consideration should be given to the addition of the Secretary of HHS.

QUESTION 1-C

C. Might the advisory board also include a representative from one of the national science groups such as NSF?

The Advisory Group could include a representative from one of the national science groups, or at least call for an intermittent input and advice from such groups.

QUESTION 1-D

D. Could you describe how some of the charges to the National Food Policy advisory group such as regional production, maximum, local employment, nutritional sufficiency and family farming relate to the existing charter of the land grant institu-

tions? Are there major constraints? Does Public Law 97-98, the Agriculture and Food Act of 1981, enhance the opportunities of the National Food Policy to succeed?

I believe that the Charter of the land-grant institutions calls upon their resources and capabilities in research, extension and training to help sustain a productive and efficient U.S. agriculture. In this sense agriculture is inclusive of farms of all types as well as agribusiness. They are expected to develop critique and dissiminate information, germane to food production as well as to the articulation of impact and consequences of policy decisions. Certainally they could play roles in making determinations as to whether goals of regionalized production/consumption, maximization of local employment opportunities, protecting positions of family farms and maintaining adequate nutritional standards are workable. The institutions should be able to assist in clarifying the benefits and cost of policies developed to guide our U.S. food production and distribution efforts. I believe that Public Law 97-98 enhances the opportunity for a national policy to succeed.

QUESTION 2-A

2. Dr. Williamson, you appear before this committee as acting Chairman of your Association of Research Directors.

A. Is that an association of 1890's school Director?

The Association of Research Directors (ARD) is comprised of representation from the 1890 Universities.

QUESTION 2-B

B. Has this group taken action in support of the National Food Policy ideas?

No. To my knowledge, this group has not taken any such actions in support of the National Food Policy idea.

QUESTION 2-C

C. In what ways would the international food supply be affected by a National Food Policy?

Food items produced for export would be targeted for specific markets and producers and suppliers would recognize peculiar product demand requirements of the importing countries. The expected outcome would be a larger and hopefully stable share of the international markets for the United States.

QUESTIONS FOR DR. KENNETH E. WING

Question 1. On page 2 last paragraph you indicate the kind of mix of agriculture product 20 years from now is important in structuring today's research agenda.

A. Please tell the Committee what measures the Experiment Station Committee on Organization and Policy (ESCOP) is taking to assure the American people and the world's consumer that ample quantities of reasonable priced food will be available in the years after 2000.

Answer. ESCOP deals with food and agricultural research policy. We can propose but not assure increased funding for research which, if well-planned and well-executed, surely will contribute to but not assure consumers an ample supply of reasonably priced food beyond the year 2000. What we would learn here would be useful elsewhere in the world. Some specific steps needed are:

1. More research on fundamental phenomena of plants and animals, and the stresses of their production environment as prerequisites to further applied progress.

2. Increased hiring of new scientists who are more thoroughly trained in the sciences basic to agriculture such as biochemistry, zoology, plant and animal physiology, ecology, systems analysis, genetics, bacteriology, virology, microbiology, chemistry and physics.

3. Strengthening interactions with segments of private industry serving agriculture's needs individually and collectively. The primary means for collective interactions include the Agricultural Research Institute (ARI), the National Industry-State Agricultural Research Council (NISARC), and liaison with the Agricultural Committee of the Industrial Research Institute (IRI).

4. Encouraging professional analyses to improve further the value of agriculture research as a useful public investment.

5. Working with the USDA to strengthen the USDA-State partnership in agricultural research as mandated in Title XIV of the Agriculture and Food Act of 1981.

6. Working more closely with the Cooperative Extension Service, particularly within the various agricultural production locations to help improve systems of production tailored to the characteristics of those locations.

B. Does ESCOP have any special organization structure such as an ad hoc committee which deals specifically with this problem?

Answer. ESCOP has just appointed a subcommittee to identify special initiatives that will be needed to met the longer range needs of American agriculture in addition to those initiatives already identified and active. Administrative and scientific representatives of the State Agricultural Experiment Stations are involved in a number of multi-organizational efforts to the same end.

C. Is there any agreement among the State Agriculture Experiment Stations (SAES) that recognizes specific units having research strengths which will be critical at some point on the 20-year research path?

Answer. There is agreement that every state station will need to strengthen one or more areas of research that will be required to meet the long range needs of agriculture. The nature of this selective strengthening will depend on what state legislatures will buy and the Federal Government will support, as well as the judgments of agriculture research leaders. ESCOP will assist any reasonable process to the end.

D. What role does ESCOP take to assure targeted funding by USDA or State legislators which will promote the accomplishment of the 20-year research plan?

Answer. ESCOP believes that it is in the national interest to continue to encourage state legislatures to invest in agricultural research. They provide most of the funding for the state stations. The proportions of their investments vary from about half to over 90 percent of the state station funds for research. State tax revenues and importance of agriculture in the state, in that order, are the primary factors influencing the total and proportional amounts of state investments.

State investments generally require significant recapture by the state of the benefits of the research. Recent analyses show that about half of the benefits of state directed agricultural research help the state in which the research is conducted. The rest is called spillover benefits to other states, some of whom may be agricultural competitors of the state carrying out the research.

Federal preoccupation with a limited number of federal priorities and the rule that federal dollars should finance only federal purposes leaves two important partial vacuums in funding. State research initiatives that could be extended with modest federal investments to benefit a number of states fail to reach the federal funding agenda. Needed federal assistance to strengthen centers of basic reseach in the state stations has not been given the budget attention that agriculture will need. This kind of selective funding in innovative capital would combine superior science and agricultural expertise in ways that would give the state stations program and funding flexibilities that the inhouse research agencies of the USDA already enjoy. The authority for such funding is already in place. Several excellent and unique examples of its value are already being demonstrated in the STEEP program to reduce erosion in the productive Palouse Hills in the Pacific Northwest and in the IR-4 program that has proven invaluable in balancing agricultural needs with public production in the EPA clearances of pesticides for minor agricultural uses.

There is a need to use federal budget development in constructive support of research program development and improvement and to capture interactions of state and USDA research that will have synergistic values to American agriculture. Congress has already mandated that improved research planning and coordination requires "relating federal budget development and program management to these processes."

There is evidence also that federal budget encouragement spawns state funding interest. The additive interests of the states in agriculture are coming increasingly closer to the federal interest whenever supply and demand for agricultural produce reach an equilibrium.

Therefore, we reiterate the proposal we made in our testimony, ESCOP and the state research system it represents will collaborate with USDA initiatives that best serve American agriculture in all of its important dimensions. Collaborative planning that recognizes both state and federal prerogatives and funding interests will do more to attract public investments than if each agricultural research institution is forced by budgetary procedures to "go it alone."

E. Could you give me some examples of research activities now being planned which you believe have a good chance of making a notable contribution to food supply?

Answer. Some examples include improvement in methods of genetic manipulation in plants, animals and micro-organisms; improvements in multiple cropping

systems; reducing needs for maintaining breeding stocks of food animals by increasing reproductive efficiency; refinement of leaf proteins for swine and poultry rations; conservation tillage; improved nutrient balance in fruits, vegetables, and grains used directly for human food; and improved efficiencies in use of irrigation water.

F. In your judgement, is the Joint Council planning process giving us a useful 20 year plan?

Answer. The Joint Council has just been reconstituted according to the 1981 Congressional mandate. We are optimistic that they will "bring about more effective research, extension and teaching in the food and agricultural sciences, but only if those who decide on funding want to make that happen.

G. Do you or does ESCOP have any recommended changes in the direction of long range planning as it is now practiced?

Answer. ESCOP supports the planning processes developed under the aegis of the Joint Council, and we subscribe to the need for longer-range planning as enunciated by the Congress in Title XIV. We believe that the effectiveness of those planning processes will be most useful to the progress of agriculture if outcomes of planning can be at least partially recognized and rewarded in the Federal budget process. That planning processes are consistent with the important levels of decision-making within USDA, and state agricultural research institutions and planning be done in a USDA-state partnership mode that encourages collaboration and cooperation but protects the integrity of the partner institutions.

H. Do you believe a national agriculture policy such as a National Food Policy as suggested by Dr. Williamson should help set research policies to guide SAES research efforts?

Answer. We believe that Federal enunciation of a National Food Policy would be of some value. To be of value, it would need to be long-range in its aspirations. It would have to attract bipartisan political support and be seen as useful by important segments of American agriculture. Periodic reconsiderations would be needed to account for changes as they take place. Drastic revisions would destroy its value, particularly for agricultural sectors requiring long-range investments and decisions.

We believe that agricultural research is sufficiently separable from other food policy issues to permit establishment of agricultural research policies without holding research hostage to solutions of other agricultural issues, particularly those that fluctuate over short time periods. In the past, agricultural research has contributed rather steadily to improved agricultural productivity and increases in production while farm prices were fluctuating. If it continues to be in the national interest to insure that supply of agricultural products will equal or exceed demands, a long-range policy for research is essential.

Question 1. What mechanism for implementation of a National Food Policy should be used or developed?

Answer. For the research portion of a National Food Policy, we believe that those who represent and understand the research institutions and their innovation processes and capabilities should be party to development of policies affecting research. We reiterate the statement in our testimony that the formation of policies should "be a partnership effort as articulated in Title XIV" of Public Law 97-98.

Question 2. In the second paragraph on page 3 of your testimony you indicate that protecting food stuffs from nutrient loss during post harvest handling is an important objective and since we have witnesses from the food industry sector we expect to hear some of that problem later. However in other parts of your testimony (number 1 on page 3, number 5 on page 4, last paragraph on page 4) the emphasis appears to be on production and efficiency.

Comment. One essential fact ties some important dimensions of preventing nutrient loss in post-harvest handling to production efficiency. If the products from the farms are degraded in any way beyond the farm gate the price penalties that result accrue to the producer. For produce used by the consumer in production form such as fresh fruits and vegetables, even the appearance of degradation or blemish has to be carefully avoided. Therefore, much of post-harvest research is considered to be an essential extension of the production process with the producer and the consumer as a buyer in mind.

A. What priorities does the Experiment Station Committee on Organization and Policy (ESCOP) place on the minimum nutrition level of the basic food product at time of harvest?

Answer. ESCOP strongly endorses the efforts of the state stations to maximize nutrient values and safety of basic food products at time of harvest. However, realities of pricing in the market place may require some producers to make tradeoffs between quality and quantity. Generally, though, pricing reflects consumer acceptabil-

ity. As consumers become more aware of nutritional requirements, we expect pricing patterns to reflect that desirable shift in demand.

B. Do you have a special task force working on this subject in ESCOP?

Answer. ESCOP does not have a special committee on this subject.

C. Are certain Universities or State Agriculture Experiment Stations (SAES) targeted with this responsibility by either USDA or ESCOP?

Answer. The targeting is determined by the agricultural commodities important to the state. State stations serving the various agricultural production regions for the various commodities have access regionally or within their institutions to research and testing capabilities to deal simultaneously with processing problems and nutritional consequences. They utilize all those resources effectively.

D. What coordination does ESCOP or the SAES practice with other agencies who have nutrition such as HHS, foundations or consumer groups?

Answer. ESCOP has urged the Cooperative State Research Service to maintain effective expertise in food processing and human nutrition research in the SAES and in other agencies of the Federal Government. Those experts participate in USDA activities and interact with other agencies and institutions on these subjects.

Each state station interacts with elements of the industry concerned with the processing, marketing, and distribution of commodities produced in the state. ESCOP names representatives to groups from time to time as those groups determine that SAES activities are important to the achievement of their purposes.

Response to Questions From Congressman James H. Scheuer to Dr. Phillips, O.T.A.

AGRICULTURAL RESEARCH LACKS WELL-DEFINED NATIONAL GOALS

1. On page 2 of your testimony you state, "The lack of well-defined, achievable national goals for U.S. agriculture is a major deterrent to the formulation of a national policy that guides the research community in planning its agenda." You state that the present goals are too vague to be achievable.

A. Would you illustrate for us what a well-defined, achievable national goal would be?

If one of our national goals is for the agricultural sector to produce an ample supply of food, it must be specific. An example might be "to provide an ample and nutritious supply of food for domestic consumption, as defined by the National Academy of Science, plus economic demands of the world market to the year 2000, while maintaining a sustainable resource base that tolerates only 5 tons an acre of erosion annually."

This specificity gives the research community the information it needs to estimate the quantity and quality of food that would be demanded and a specific constraint on the deterioration of the natural resource base that would be tolerated to reach this goal.

B. What mechanism would be most effective in setting well-defined, achievable national goals?

Congress and/or the Executive Branch are the logical entities to establish these goals. Public funds would be spent on research needed to meet goals established by society through its elected officials. Since Congress in particular provides the funds for research, it should set the broad goals and expect the research community to respond to them.

C. What mechanism or process would insure that the goals are achieved in the agricultural research system?

The best mechanism to insure that the goals are achieved is through oversight by Congress. This can be accomplished by periodic hearings by the legislative committees responsible for food and agriculture and annually by the respective appropriations committees responsible for providing funds to conduct this research.

LACK OF RESEARCH PRIORITIES

2. On page 2 you state, "No satisfactory long-term process exist for evaluating research activities, research opportunities, and developement of research priorities within the food and agricultural system. Decisions are made on an ad hoc basis with little coordination among USDA, SAES, and other agencies conducting food and agricultural research."

A. How could a long-term development of research priorities be most effectively implemented?

B. Who should be involved in setting national research priorities?

C. What follow-through mechanism could be used to insure effective implementation?

Long term development of research priorities could be implemented by the preparation of a national research agenda. Such a study would: (a) evaluate what is being done, existing priorities, and needed research opportunities, and (b) develop a new set of research priorities and recommendations.

The study would use methodologies pioneered by the National Academy of Sciences' World Food and Nutrition Study and the OTA studies on nutrition research alternatives and emerging food marketing technologies for priority determination.

Once conducted it could be updated every 4 years with a report delivery date of December 1 of the year of each Presidential election. The timing would coincide with both the installment of an administration and the enactment of the farm bill.

Such a planning system would not be institutionalized in terms of the individuals involved. A cross section of scientists, research administrators, users, and consumers would be included. The staff conducted the study would be very small, consisting of a director, deputy director and a few assistants. The bulk of the work would be conducted through the various work groups of participants. This ad hoc feature is viewed as being critical to success in long-range infusion of new ideas.

Short-range planning would be done regularly by each research entity in conjunction with budget preparation. To bridge the gap between priorities and budget, research units would give special attention to how their proposed research budget fits into the achievement of the goals established by the priorities identified in the long-range plan. Flexibility would exist for individual research units to emphasize those designated priorities that fit most closely their agricultural situation. This system is not meant to be a national priority setting for SEAS, since they are primarily responsible for State and the local issues. But it is a system of national priority setting for broad regional and national issues.

Using the concept of long-term priority establishment and short-term budget planning, the Joint Council and Users Advisory Board would modify their responsibilities to place emphasis on: (1) supervising the planning process, (2) providing a forum for communication, and (3) providing interim evaluation of planning goals. Specifically, they would assist in identifying and recruiting scientists, administrators, users, and consumers to be part of the long-range planning process. They would be the focal point in monitoring and evaluating the extent to which the research system is meeting the objectives specified in the long-range plan. They would also provide an interim evaluation of priorities in light of changing conditions in agriculture.

The whole process would be conducted on a continuous rolling basis that generates reports of past accomplishments, support for budget hearings, and periodic reports on longer term priority needs of budget planning and authorization.

The key ingredient in a long-range plan of research priorities is follow-through. The results of the study must be used for the plan to be effective. It must be an integral part of the appropriations process. The appropriations committees can use the results of this system-wide study as a guide for (a) identification of agricultural problems, (b) the research needed to attack those problems and (c) the funding required to support this high priority research.

FEDERAL FUNDING FOR FOOD AND AGRICULTURAL RESEARCH

3. On page 4 you indicate that USDA research exenditures have been the smallest of any major Federal research agency. On the international scene, you indicate that the increase in agricultural research funding was the smallest for the United States than any other country or region.

A. Did the OTA study indicate what the reasons for the slow growth in agricultural research were?

B. Over the long-term, what will be the significance of this slow growth in agricultural research?

The study did indicate that over the years there seemed to be a lack of appreciation of the USDA policy level of the importance of agricultural research. A prime function of the SAES directors and the highest science policy advisor to the Secretary of Agriculture is to assure that the importance of agricultural research is maintained in policy decisions. Historically, Congress has provided the amount of funds requestd by the Administration and sometimes more than was requested. The various Administrations, over the past decade and a half, have not requested sufficient funds to carryout effective research programs.

This slow growth: (a) does not allow research institutions to keep pace with higher research costs, (b) does not allow research into new problem areas without reducing

11-864 O - 83 - 23

significant levels of effort in important traditional areas, and (c) does not allow the U.S. to maintain the strength and responsiveness necessary in meeting growing U.S. and worldwide needs and demands for food and agricultural products. From an equity consideration, the ratio of federal funds to state funds for research will not improve, causing taxpayers in food surplus states to continue subsidizing consumers in food deficit states through their investment in agricultural research.

C. On page 9 you conclude by stating, "Thus, competitive grants should be given serious consideration as a source of increased funds for food and agricultural research in the future." Would you explain the advantages of such a mechanism for increasing productivity?

Competitive research grants in conjunction with formula funds and special research grants are the major mechanisms for USDA to distribute funds to research institutions to conduct research of interest of USDA. The advantage of competitive grants lies in the differences among competitive grants, formula funds and special grants. All colleges, universities, Federal agencies, and private institutions are eligible for competitive research grants. Federal formula funds are available only to state agricultural experiment stations (SAES), on a formula basis, and special research grants are available to land grant colleges and universities, SAES, and other college and universities that have a demonstratable capacity in agricultural research. Thus, competitive grants are open to all research institutions, including those outside the traditional agricultural research complex, whereas special grants and formula funds are directed largely toward traditional agricultural research institutions. In addition, competitive grants emphasize basic research.

The competitive research grants are useful in providing flexibility in funding research areas that have been identified as high priority because of changing economic conditions or other conditions, or where research indicates that increased effort has a high probability of being successful. Such grant funds are concerned with relatively short-term projects—i.e., 2 to 5 years (even though these may be directed toward long-term problems). Another advantage of competitive grants is to obtain expertise in certain research areas where it is unavailable from either the SAES or USDA. This advantage is important where it becomes necessary to cross scientific disciplinary lines to make new breakthroughs in science. Such interdisciplinary activities involve technological approaches not normally associated with agriculture. Information research is one example. Crop planting and irrigation monitored by satellite remote sensing are examples where the use of such information is increasing agricultural productivity.

COORDINATION OF RESEARCH

4. On page 9 you state, "At least ten Federal agencies other than USDA fund or conduct some kind of food and agricultural research. . . . However, the degree of overlap and coordination cannot be determined at this time because the mechanism for coordination is not functioning well."

A. What changes are necessary to improve the coordination of agricultural research?

B. The Committee on Food and Renewable Resources (CFRR) was mandated by Congress in 1977 to coordinate research. What are the reasons that the Committee has not been effective to date?

Congress has established the CFRR to coordinate food and agricultural research among the Federal agencies conducting or funding this research. CFRR, chaired by USDA, is primarily charged with improving planning, coordination and communication among the Federal agencies. The most important change that is needed is to improve the commitment of the agencies to work together and allocate the needed resources into meeting the intent of Congress.

Besides lack of commitment, other reasons for CFRR's ineffectiveness are: (a) difficulty in establishing a definition of food and agricultural research, especially for human nutrition research conducted in USDA and Department of Health and Human Services, (b) normal "turf battles" that arise when a new entity like CFRR emerges within a well-entrenched bureaucracy, (c) lack of specific, highly defined objectives, and (d) lack of authority of individual agencies that might be addressing the same problems from a more authoritative positions.

USDA ORGANIZATION TO ADDRESS NATIONAL RESEARCH PROBLEMS

5. On page 11 you state, "USDA does not have an organizational structure that is conducive to focusing on national and regional problems."

A. What changes should be made in USDA so that the agency could effectively focus on national problems?

When the Agricultural Research Services (ARS) reorganized in 1972 it transferred line responsibility to four regional administrators to be located within each of the SAES regions. This left the National Program Staff (NPS) without direct line responsibility for program development, staff selection and resource allocation. This caused ARS to lose much, if not all, of its ability to plan, manage, and conduct research on broad regional and national problems. To correct this situation it will be necessasry to transfer line authority, including responsibility and accountability for planning and coordination of research and resource allocation for regional and national research, from regional administrators to the NPS.

This action would reduce wasted manpower, needless duplication, and eliminate many of the unnecessary and unproductive debates in developing regional and national programs. It would greatly facilitate the development of national research leaders, strengthen the scientific aspects of the programs, help to focus the problems on the important regional and national issues, and improve cooperation with SAES scientists and other scientists. This provides an opportunity for close contact between research scientists and their immediate NPS specialists and the assurance of coordination of various disciplines at the proper level.

Resource allocation decisions would be made by scientists interested in broad regional and national concers. This would make it more difficult for local interest groups to divert the efforts of the local AR scientists and budgets to local and State problems.

The geographical area covered by each regional administrator was chosen to coincide with the SAES regional areas and has little significance with truly regional research problems. Such problems do not follow State lines, nor does any group of regional problems fall within the same cluster of States. Consideration should be given to whether there is a need for four such regional administrators and their best geographic locations. It was beyond the scope of the OTA assessment to study the specific number needed and their most effective location. However, the findings of the study raise questions concerning the need for and efficiency of the present number and their location.

B. On page 15 you conclude, "Under the present administration, there has been little, if any, effort to coordinate human nutrition research among Federal agencies." Is this a result of a decision by the leadership or the lack of an adequate organizational structure?

This is basically the result of decisions made by USDA, OMB and the White House. The previous Administration had developed an adequate organizational structure to begin to meet the intent of Congress in developing a national research effort on human nutrition research. It was the decision of this administration to abolish that organizational structure, decentralize its human nutrition research program, and separate its nutrition information function from the nutrition research function. Such segmentation of research inhibits the ability of USDA to develop a coordinated national research program.

Dr. Gahr, GAO

LONG-RANGE PLANNING FOR AGRICULTURAL RESEARCH AND DEVELOPMENT

On page 3 of your testimony you concluded that is was unlikely that national long range planning for agricultural research and development could be undertaken immediately given the inhibition factors facing the agricultural research planning system.

A. What alternatives to the Joint Council have been discussed?

B. Have you considered a National Food Policy advisory group such as advocated by Dr. Williamson in his testimony? Is so, what were your findings?

C. What should be the components of a national long range agricultural research plan?

GAO Answer. In our July 24, 1981 report, "Long-Range Planning Can Improve the Efficieny of Agricultural Research and Development," we recommended that the Secretary of Agriculture develop an agency-wide long-range plan for agriculture research and development. However, we also recognnized the difficulty in initiating a long-range planning process and suggested that the Department of Agriculture, in conjunction with the States and their land grant colleges and experiment stations, make a food needs assessment as the first step in developing long-range goals and objectives for the agricultural sector and in determining the research required to meet the identified needs.

Since the Joint Council's primary responsibility is to foster coordination of agriculture research, extension and teaching, we believe the Joint Council could play a major role in planning by coordinating the food needs assessment and research needs assessment.

We did not conduct a detailed evaluation of the National Food Policy advisory group proposed by Dr. Williamson, but recognize the need to coordinate food policy with the various Department Secretaries and with State and private representatives. In an earlier report, "Inventory of Federal Food, Nutrition and Agriculture Programs," September 11, 1979, we indicated that no single Government unit oversees the vast array of U.S. food-related programs; rather, 29 agencies carry out these programs independently. As a result, the 359 Federal food, agriculture and nutrition programs—affecting, not only the national economy, but the world economy as well—are implemented without coordination and cannot provide the overall picture of U.S. food policy.

By long-range planning, we mean a period of from 5 to 50 years. The time frame of a plan normally varies with the volatility of the subject. We defined the long-range planning process as including the following essential elements:

Identifying problems, needs to be met, or opportunities to be realized.

Determining concensus goals or objectives.

Selecting the means to reach the goals after analysis of alternative options.

Determining priorities for research and development efforts.

Preparing operational plans.

Continually updating and evaluating the long-range plan.

Dr. Williamson did not mention the role of the Joint Council's "Food Needs Assessment" in developing a National Food Policy he advocates.

A. How may these two activities be related?

Dr. Williamson points out the purpose of the agriculture sector is the production of food for consumers. He also highlights the interdependence of food policy with many other Departments in addition to Agriculture. A food needs assessment coordinated by the Joint Council could be presented to the Advisory Board suggested by Dr. Williamson to help the Board in its deliberations in developing a National Food Policy.

FOLLOWUP QUESTIONS TO DR. DENIS J. PRAGER, ASSISTANT DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY, EXECUTIVE OFFICE OF THE PRESIDENT

Question. 2. Public Law 95-113, the Food and Agriculture Act of 1977, designated USDA as the lead Federal agency for agricultural research. Its coordination role was reaffirmed and strengthened in Public Law 97-98, the Food and Agriculture Act of 1981. In your testimony on page 8, paragraph 2, you indicate other agencies (NIH, NSF, DOE, and DOD) support research significant to agriculture.

A. What proportion of Federal funding to support research significant to agriculture goes to USDA, and what proportion to each of the other agencies listed?

Answer. Approximately 60 percent of the total Federal Government investment of $2 billion per year in the food and agricultural sciences is provided by the Department of Agriculture, 40 percent by other federal agencies.

B. What is the coordination procedure between these agencies and USDA?

Answer. A number of mechanisms, both formal and informal, exist for facilitating coordination between the USDA and other federal agencies supporting the food and agricultural sciences. The formal interagency coordination mechanism is a committee, under the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), mandated by the Food and Agriculture Acts of 1977, and 1981. In the 1977 legislation, the committee was called the Committee on Food and Renewable Resources (CFRR); the 1981 Act changed that name to the Committee on Food, Agricultural, and Forestry Research (CFAFR). This committee was established by Congress for the express purpose of providing a mechanism through which the USDA can exercise its lead agency responsibilities in the food and agricultural sciences and encourage and promote coordination among the federal agencies which support or conduct research related to agriculture. Other, informal mechanisms, such as the Interagency Committee on Plant Sciences, organized by the National Science Foundation, are effective mechanisms for facilitating interaction and coordination among scientists and program managers involved in various aspects of the food and agricultural sciences.

C. What role does OSTP take in reinforcing the lead agency role of USDA?

Answer. The Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) is a high-level, interagency coordination mechanism originally estab-

lished by Congress to provide the Director of the Office of Science and Technology Policy with a ready mechanism for facilitating coordination among the several federal agencies with significant science and technology programs. Through its operation of the FCCSET mechanism, OSTP has formal responsibility for helping the USDA exercise its lead agency authority through the Committee on Food, Agricultural, and Forestry Research. Less formally, the OSTP works with research managers within USDA as well as in the other federal agencies to assure that federal resources available for the support of the food and agricultural sciences are optimally allocated.

Question. 3. Public Law 95-113, the Food and Agriculture Act of 1977 (as amended by Public Law 97-98) designates membership on the Joint Council. The President's Office of Science and Technology Policy is a member. Your testimony on page 17, paragraph 3 does not suggest that the Joint Council will make great strides in planning and coordination.

A. In your view, by what means does the science community focus on future needs of agriculture research?

Answer. It is my sense that the community of scientists involved in the food and agricultural sciences can readily agree on high priority future agricultural research needs. A number of organizations and conferences over the past decade have assessed the current state of the food and agricultural sciences and defined the future research needs. The problem lies not in the identification of research needs but in seeing that those needs are met. The diversity and decentralized structure of the agricultural research system and its tendency to focus on solving near-term problems of American agriculture all mitigate against sufficient attention to meeting future, longer term research needs.

B. What form does this focus take if not a "formal, centralized plan"?

Answer. The development of formal, centralized plans conjures up the vision of formidable documents which define predictable and controllable steps in a process designed to meet specified goals. Perhaps because the conduct of basic science is neither easily predicted nor controlled, formal planning in agricultural research has tended not to be an effective means of meeting agricultural research needs. What is needed, instead, is an ongoing process through which scientists, both from inside and outside the traditional agricultural research system, collaborate in identifying critical gaps in our scientific knowledge, identify the sectors and institutions most appropriate for supporting and conducting the research required to fill those scientific gaps, select the funding mechanism most appropriate for support of that research, fund the most meritorious research programs, and evaluate the progress in various scientific fields.

C. How should the critical needs of agriculture be identified?

Answer. The critical needs of American agriculture must be identified through a process in which scientists from all sectors interact with producers and other "consumers" of research to identify high-priority problems and define research designed to solve those problems.

Question 4. On page 7 you state one of the problems in agriculture research is "inadequate cooperation and coordination among the various institutions involved in agricultural research . . ."

A. What steps is the Administration taking to correct this problem?

Answer. The Administration is attempting to improve cooperation and coordination among the various institutions involved in agricultural research by: clarifying the roles of the various sectors and institutions involved in agricultural research; strengthening the scientific leadership and research capabilities of the research components of the Department of Agriculture; reducing the administrative burden imposed by the Federal Government on State Agricultural Experiment Stations and land-grant colleges; enhancing the effectiveness of the Joint Council on Food and Agricultural Sciences; and reestablishing the interagency committee responsible for coordinating agriculture-related research supported and conducted by the Federal Government.

B. What changes, if any, will be made in the USDA in order to increase coordination and cooperation in agricultural R&D?

Answer. Steps are being taken to: define and clarify the research mission of the ARS and strengthen its scientific capabilities; reduce the administration and oversight responsibilities of the Cooperative State Reserach Service (CSRS) and refocus its attention on scientific leadership and coordination; provide the new Assistant Secretary for Science and Education with the support required to implement his/her mandates to enhance the productivity of the entire agricultural research system.

C. If changes are brought about, how will they be "enforced" over the long-term?

Answer. There are no mechanisms to assure that increased cooperation and coordination among the various institutions involved in agricultural research can be "enforced" in such a way that they are sustained over the long-term. No matter what administrative, bureaucratic, or legislative mechanisms are put in place, cooperation and coordination will always depend upon the willingness of individuals to overcome natural barriers and inhibitions in order to pursue research interests in common with others.

Question 5. On page 9 you indicate that, ". . . the Administration is taking steps to: clarify the appropriate roles of the public and private sectors in the support and conduct of agricultural research; . . ."

A. Please be more specific and indicate what these steps are.

Answer. The Administration is taking a number of steps to clarify the appropriate roles of the public and private sectors in the support and conduct of research and development. These include: presentations, to various audiences, designed to define appropriate public and private sector roles; specific programmatic changes designed to increase appropriate, and decrease inappropriate, research supported by various federal agencies; budget actions designed to implement Administration policies concerning public and private sector roles; and implementation of specific incentives designed to enhance private support and conduct of research and development.

B. When can we expect full implementation of these steps?

Answer. Policies related to the roles of public and private sectors in the support and conduct of agricultural research will be implemented over the life of the Reagan Administration.

Question 6. On page 13 you state that the Administration's research policy should include, ". . . the identification of research needs, the setting of research priorities, . . ."

A. What mechanism is the Administration using to identify these needs and set up priorities?

Answer. Several mechanisms are being used to identify research needs and set research priorities within agriculture. These include: the development by ARS Of a strategic research plan; publication by the Joint Council on Food and Agricultural Sciences of an assessment of research needs and priorities; and identification and support via the competitive grants program of high-priority basic science.

B. How will the Administration quantify the progress of meeting these needs?

Answer. As of yet, no means have been identified for quantifying the progress of meeting research needs.

C. Will these research needs include long-range needs? If so, how will you identify them?

Answer. The mechanisms identified above are identifying long-range research needs.

Questions for Dr. John L. Brooks

1. On page one, paragraph two, you state that NSF is unique among Federal agencies because it is charged with overseeing the health of science across the entire spectrum of scientific disciplines. You further state on page two, paragraph two, that the primary criteria for selecting proposals for award are scientific merit and potential contribution to scientific knowledge.

A. What processes does NSF follow in guiding or steering research effort to assure the long term availability of desired research results?

NSF uses a rigorous peer review system to select for support the best of unsolicited research proposals in all fields of science. Grantees are encouraged to publish results of their research in the open scientific literature so that results are readily available. Further, in cases of clear relevance to practical issues, results are brought to broad attention through presentation and discussion in workshops, conferences or other meetings.

B. How is this process adaptable to long range planning for agriculture research?

The contributions of fundamental research are often a significant element in long-range planning. For example, modern techniques of genetic engineering derived for basic studies have important implications for future developments in agriculture. These techniques arose from the cumulative results of 20–30 years of research in various fields of biology and chemistry. Similarly, advances in integrated pest management have depended upon improved understanding of the relationships and interactions among plants, insects, and environmental conditions. Today's fundamental studies should be examined for their potential contributions to practical issues of the future.

C. What role has NSF had in assisting the current Joint Council and User Advisory Board planning?

To date, NSF has not been called upon to assist the Joint Council or the User Advisory Board of the Department of Agriculure.

2. Several witnesses and the OTA report have suggested a need for a more precise description of long range agricultural research objectives. NSF accomplishes its mission through the competitive grant process, often by USDA or State Agriculture Experiment Station scientists.

A. What role should NSF play in helping coordinate as well as a support agriculture research?

NSF has organized an informal interagency committee on the plant sciences. The Committee, which meets monthly to discuss matters of mutual interest, is composed of agency staffs which have direct interactions with working scientists.

A report on Federal support of research in the plant sciences, issued in 1979, was the first document that identifed support for plant science research separately from support of all agriculture-related research. A second report on Federal support of high priority research in the plant sciences is to be published within the next few months. These reports are useful in formulating both short- and long-range plans.

Also, the Foundation joins the Department of Agriculture in support of research projects of mutual interest.

B. What proportion of your awards on the average are granted to agriculture industry research scientists?

On the average, less than one percent of NSF awards are to agriculture industry research scientists.

Questions to Dr. Emery N. Castle

1. In reference to your comments on page one, paragraph two, concerning exports, world markets for commodity exports are highly competitive and this fact has been given as one, but not the sole reason the U.S. has lost some major export markets in recent years.

A. As an agricultural economist, what agricultural research plans do you envision are needed to improve basic efficiency without subsidizing, transporting, or offering trade credits?

B. Is there an adequate forum in our current research planning process to consider the economies of additional pre-export processing of raw agricultural products as a national goal? If so please explain.

2. On page three, paragraph one, you advocate the formulation of long term objectives and broad development strategies. It has been noted that you have not used the word "quantifiable".

A. Is it probable that goals and objectives for agricultural research can be so structured that the shorter term operational and project plans can fit neatly within, without leaving large gaps in vital knowledge?

B. Can these goals be stated so that measurable target actions can be assigned within USDA and by the SAES to their respective units?

3. On page three, item one, you refer to the keen competition for competitive grants.

A. Without lowering the formula fund levels, what effect would doubling of the competitive grant funding have on measurable long term research results?

4. You indicate on page seven, item three, the urgent need for examination and guidelines for public and private sector responsibility for agricultural research.

A. What kinds of groups should be leading this effort?

B. In what roles would the private sector contribute to long range research plans and programs?

5. On page seven, item four, you indicate Congress has a responsibility to help maintain the credibility of the ag research system.

A. Could you be more specific in your recommendations?

6. On page eight, paragraph three, you refer to your findings presented in November 1980.

A. Are those findings summarized in your testimony given here today?

B. Would you change any substantive part of your 1980 statement?

Responses to Questions from Emery N. Castle

1(A) I believe there are a great many research activities now underway that if successful, will make U.S. agriculture more competitive on a world-wide basis.

Almost all of the research that is planned and underway on field crops and grains has this potential.

1(B) There is an adequate forum for the consideration of these matters. I cannot say, from my knowledge, whether or not such matters are being considered adequately.

2(A) It is possible to mesh short and long-run objectives in research planning.

2(B) Perhaps. However, I am more inclined to assign areas of responsibility and then audit performance than I am to establish quantitative goals for research.

3(A) Competitive grant funds are at such a low level currently that doubling them is not likely to have great effect. Nevertheless, this would be a step in the right direction.

4(A) I would like to see this administration appoint a task force and give it this responsibility. The task force should include people from educational institutions, USDA, the private sector, as well as from foundations.

4(B) I believe the private sector should be involved in a general way in longrun research plans and programs. I do not believe they should be involved in detailed planning.

5(A) I believe Congress could simply state that it is its wish that agricultural research should be scientifically based and that its administration should be independent of politics.

6(A) Yes.

6(B) No.

QUESTIONS FOR DR. HAROLD L. WILCKE

Question 1. Your statement in the last paragraph of page 4 and on page 5 concerning acceptance of research results concerns several members of the Committee.

A. How does the agricultue scientist community propose to resolve this problem?

Answer. 1. By inviting key figures and doubters to visit the industry research facilities to both see and hear what the research programs are at specific companies.

2. By continued presentation of papers at scientific meetings and publication of scientific papers in recognized journals.

(The 1977 Farm Bill, establishing the U.S.D.A. as the lead agency in agricultural research and education has been a distinct help in getting recognition for agricultural scientists.)

B. Do professional society groups take some position on this problem?

Answer. 1. A group of agriculture scientists have petitioned for the establishment of an Academy of Agriculture on the National Academy of Sciences.

2. The Agricultural Research Institute is active in this area.

Question 2. In a recent article in the Prairie Sentinel, a Midwest magazine, the danger of industry grants siphoning off large blocks of public research facility time and manpower to accomplish short range industry research targets was cited.

A. Does this suggest a lessening of the tension between public and private scientists?

Answer. The transfer of scientists from public to private employment is longstanding, and it is beneficial, but unfortunately, those who do not understand or recognize industry research are not usually among those who transfer, partly because of preference, and partly because they probably couldn't make it in industry if they did seek employment there. The article in Prairie Sentinel probably referred to the emphasis on genetic engineering, and their reason for apprehension that the academic ranks may be depleted to the point where there is not adequate training for replacements in the short-run. However, as this settles down, it will be self-correcting, particularly as realism sets in regarding the speed of financial return from this particular tool.

Question 3. You mention on page 5, paragraph 4, the cooperative effort of the Agricultural Research Institute and the Industrial Research Institute.

A. Have these groups formally approached U.S.D.A. and the Users Advisory Group to emphasize the need for a long range agriculture research program and plan?

Answer. Answered in testimony.

Question 4. The Committee is interested in your statement on page 7, paragraph 3, we assume you refer to product processing.

A. Is there any long range plan to try to grow crops which most nearly match or substitute for traditional food stuffs in developing countries?

Answer. The National Academy of Sciences, Foreign Office and A.I.D. have made some studies of plants and animals found in developing countries. Kansas State Uni-

versity, Florida University, and probably others have attempted to develop food products to imitate those found in some developing countries. We should be doing more of this and should find some benefits from this type of work for new crops and crop uses in this country..

Question 5. On page 7, paragraph 1, you discuss post harvest loss in quality. The Committee is also interested in your views on maintaining or improving the quality, particularly the nutrition level of crops at the time of harvest.

A. Do you know of any extensive studies concerning increasing the basic nutrition value of raw agricultural crops?

Answer. Research has been done to: (1) Increase the methionine content of the soybean; (2) increase the lysine content of corn and grain sorghums; (3) improve the quality and quantity of wheat protein; (4) improve the protein content of barley; and (5) decrease the erucic acid content of rapeseed.

There are doubtless many others, but the point is that this need has been recognized, but not exploited as much as it might be.

The area that has need sadly neglected is the problem of maintaining nutritional value after harvesting up to the time of consumption.

B.Do you know of any extensive studies concerning increasing the tastiness of raw agricultural crops?

Answer. We need to know more about the causes for the more desirable flavor and aroma of "vine ripened" fruits and vegetables. This will require better knowledge of the chemistry and biochemistry, as well as physical characteristics of the food products. Unfortunately, some pioneering work in this area has been discontinued, primarily, I believe, because of lack of funding.

Additional Questions for Dr. Harold L. Wilcke

PRIVATE INDUSTRY FUNDING FOR RESEARCH

Question 1. On page 2 of your testimony you state, "The most recent estimates of private sector expenditures for agricultural research have been somewhat in excess of $1 billion annually."

A. What amount, if any, is for long-range research?

Answer. The surveys have not addressed the question of long-range research specifically, although basic research, in general, could be considered long-range. This constituted 9 percent of the industry expenditures.

B. Are the results of this research generally published in peer review journals? Are the results shared with other scientists?

Answer. Some of the results of industry research are published in scientific journals, but not all of it, by any means. The research producing whst is considered specifically proprietary is not published. That which is of general nature, such as the effects of growth regulators, antibiotics, etc., may be published.

ROLE OF PRIVATE INDUSTRY IN PLANNING

Question 2. On page 5 you propose a coordination system involving private industry which would be represented by the Agricultural Research Institute and the Industrial Research Institute. Further in the testimony you state, "This is a concept that is being tested in a small way at the present time but we feel that it should be recognized and expanded."

A. Please give us some more information on this small project. How is it being conducted? What are the results? etc.

Answer. The Agricultural Research Institute has compiled a list of interested members, classified by research interest and expertise, who are available to the ARS or State agricultural Experiment Station personnel to provide industry reaction, suggestions and criticisms or subjects where industry input is desired. This would be an informal review for information only.

The Industrial Research Institute has a relatively small group organized as a subcommittee of the Federal Science and Technology Committee of IRI which has been working with the Office of Science and Education of the USDA on an informal basis to provide advice and recommendations.

The use to which such counsel is put is the prerogative of the USDA.

B. Do you think that cooperation between private industry and the public sector would be hindered by the trade secrets aspects?

Answer. Cooperation between industry and the public sector would do much to clarify interests of both groups. Trade secrets are not involved in this type of cooper-

ation. There is an extremely broad field of mutual interest over and above any private interest areas.

C. Much of your testimony relates to problems in applied research. USDA is presently deemphasizing research in this area. Would this difference in mission of research cause problems in coordinated research efforts?

Answer. There is no sharp line of distinction between basic and applied research in mission oriented programs. In fact, there are purists who would like to classify all mission oriented research as "applied", rather than "basic". This is a question of semantics and should have no bearing on the discussions of agricultural research. USDA is properly putting more emphasis on basic research, although industry will continue to be involved in basic research also, but to a much lesser degree. The application of the more basic research results to product development or to other applications such as soil erosion control, should be the primary responsibility of the private sector, with guidance from the public sector.

CHARTER

Hearings on the Agriculture Research Needs Over the Next Two Decades

SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH, AND ENVIRONMENT
of the
COMMITTEE ON SCIENCE AND TECHNOLOGY

July 27, at 9:00 a.m. and July 29, at 1:00 p.m.
Room 2318 Rayburn House Office Building

I. OBJECTIVES

1. To explore the Nation's agriculture research needs and goals for the next twenty years.

2. To examine the current capacity of the agriculture system to meet the long-range needs.

3. To determine what additional research mechanisms will be needed to fulfill the future research needs.

II. BACKGROUND

The largest industry in the United States is the agricultural and food industry. The value of farm assets in 1980 was $900 billion and one of every five civilian jobs was in the agricultural and food industry. The success of this large agricultural industry is due in part to the adaption of technology, which was developed through research. Agricultural research contributes to the basic knowledge essential to the continuing efficient production of food, fiber, and forest resources. However, it appears that presently the problems are growing faster than the solutions that can be provided by scientific research.

Two subcommittees of the Committee on Science and Technology held joint oversight hearings on "Agriculture Research and Development" in 1975. The two days of hearings produced several statements that were related to the state of agriculture research in the United States:

1. Major change in agricultural productivity will have to wait the discovery of new major technology.

2. In the area of agricultural research bold moves are called for in reshaping administrative philosophies and organization, reestablishing goals and missions, training of research scientists, and the allocation of resources.

3. There is unwarranted duplication of research efforts in some areas along with a low-level of coordination and integration of the State Agricultural Experiment Stations (SAES) and the USDA efforts.

4. It was recommended that the USDA seek a greatly increased level of appropriations for a competitive grants program, which should include support of basic research in the sciences that underpin the USDA mission.

In that same year a National Academy of Sciences - USDA joint committee reported that there is "... an urgent need for establishing national goals and policies in food and nutrition research including an improved institutional framework for reporting, observing, and managing the wide range of U.S. research activities related to food."

Within the past year three separate reports have mirrored similar concerns. A 1981 GAO report on long-range planning for agricultural research and development found that, "The U.S. agricultural research and development system does not perform national long-range planning which would meet or satisfy generally accepted definitions of such planning." The study also found that, "Because most planning that is done is not national long-range planning, no rationale for this type of planning has been developed." The report went on to define long-range planning as containing the elements of established goals, selecting strategies for achieving those goals, and setting priorties.

A September 1981 CRS report stated, "The various interactions between Congress, Administrations, college officials, scientists, and the public, affecting agricultural research have been tortuous and complex since its beginning. Basic policies and institutions have changed little in recent years but changing economic and social conditions have altered the scope of the research mission."

OTA completed an assessment of the "United States Food and Agricultural Research System." The report stated, "...there is some question as to whether USDA has a national research program or merely a series of local and regional activities. Consequently, USDA and SAES appear to be working on seemingly indistinguishable problems. Many people, including Congress, have voiced concern that little, if any, overall planning and coordination of research exist, especially at top levels of administration. They question whether national issues are receiving adequate attention. Further, there seems to be much duplication and vying for funds."

III. HEARING

The United States is running out of water in several areas, drought persists in much of the country, excessive rates of erosion on some of the most productive lands may prohibit maintenance of a sustainable system, increased cost of fuel and fertilizer threaten to price products out of reach, and environmental concerns continue. Research into the appropriate technology could provide alternative techniques and methods that would help to overcome these problems while increasing agriculture productivity.

This is the first in a series of hearings designed to examine the status of agriculture research being conducted and the future needs of research in the United States. The overall purpose is to study the state-of-the-art in various areas in agriculture and then establish, if needed, overall measurable goals and directions for agriculture research in America.

Witnesses will be invited to testify from government, universities, private industry, and other sectors involved with agriculture research.

A Report by the General Accounting Office, July, 1981

Long-Range Planning Can Improve The Efficiency Of Agricultural Research And Development

Increasing demands for food and fiber combined with increasing pressures on agricultural inputs--water, land, and energy--make it all the more important that national long-range planning be undertaken for agricultural research and development. Currently, such planning is not being conducted.

Proposed legislation would require the Department of Agriculture, in conjunction with the States, to make a food needs assessment as the first step in developing a national long-range plan. They would then be able to determine the research required to meet identified food and agricultural needs.

In addition, GAO recommends that the Department prepare a long-range plan for the agricultural research it funds and directs.

SCIENCE, July, 1982

SCIENCE, VOL. 217, 2 JULY 1982

USDA Research Under Fire

A ripple of anxiety spread through the Department of Agriculture (USDA) with the news that the White House was sponsoring a "small, highly focused" meeting on 14 June to talk about strategies for raising the quality of agricultural research. The meeting, held at the Winrock Conference Center in Morrilton, Arkansas, was co-sponsored by the Rockefeller Foundation. Concerns about the purpose of this gathering were sharpened by an advance report in the newsletter *Science & Government Report*, headed, "White House Aims to Shake up Agricultural R & D."

Now the meeting is over and guardians of tradition may be reassured: the outcome will not be a call to revolution but another modest proposal asking the government to spend more money on competitively awarded grants for basic research. Since there is no political support for cutting into other USDA programs to secure such funding, and since new appropriations seem unobtainable, little change is expected for now.

Because the subject is sensitive, the 15 participants* in the meeting are saying little about their recommendations. Denis Prager, a staff official in the White House Office of Science and Technology Policy, together with John Pino of the Rockefeller Foundation, will have a full report out in several weeks. In the meantime, they refer the curious to four points of agreement achieved at the meeting.

- The state agricultural experiment stations should remain highly autonomous, and their chief mission should be to deal with state needs. The experiment stations are the backbone of the federal-state cooperative research effort, receiving about one-third their funding from the USDA.
- The federal Agricultural Research Service should be granted more administrative flexibility, that is, freedom from local interests, in order to focus on topics "related to unique federal responsibilities."
- Collaboration between the state and federal research systems should concentrate on large issues of regional or national concern.
- "The basic science and research capability" of both state and federal research programs "need to be strengthened." While the conferees sought to reassure the traditionalists that the present system of "formula funding must be retained," they also noted that "additional support . . . should be substantially enhanced through competitive funding."

Ever since the publication in 1972 of the "Pound Report," a National Academy of Sciences review that sharply criticized USDA's research program as sluggish, experiment station scientists have been leery of reform proposals coming from Washington. One small innovation, the establishment of a competitive grants program funded at $15 million, caused a stir when it was launched in 1978. It was designed to interest molecular biologists in problems relating to food and animal production. The program ran into a wall of political opposition from state organizations. State officials saw it as a potential threat to their 100-year-old land grant system, which essentially divides funds along geographical and political lines. Some feared that powerful universities such as Cornell, Harvard, and the University of California would muscle in and take over agricultural research. That has not happened.

Although the land grant colleges win about half the awards from the competitive grants program, they have not been entirely convinced of its value. This program, copied after the peer review systems of the National Science Foundation and the National Institutes of Health, has had a difficult time in Congress. Each year it seems to go through a strenuous battle for survival. The White House–Rockefeller Foundation review will serve as a reminder in the midst of this struggle that problems have not changed since the 1970's: the need to encourage basic research in agriculture grows stronger each year.—ELIOT MARSHALL

*In addition to Prager and Pino, the participants were Perry Adkisson of Texas A & M, James Bonnen of Michigan State, Winslow Biggs of the Carnegie Institution, Representative George Brown, Jr. (D-Calif.), Irwin Feller of the Institute for Policy Research and Evaluation, Ralph Hardy of DuPont, James Kendrick of the University of California at Berkeley, Terry Kinney, Jr., of the Department of Agriculture, Lowell Lewis of the University of California at Berkeley, Judith Lyman of the Rockefeller Foundation, James Martin of the University of Arkansas, John Marvel of Monsanto, and Peter van Schaik of the Department of Agriculture.

"AN ASSESSMENT OF THE U.S. FOOD AND AGRICULTURAL RESEARCH SYSTEM"
by the Office of Technology Assessment, Report OTA-F-155, December 1981

Summary

The food and agricultural industry in the United States is by far the largest of all our industries. In 1980, farm assets totaled over $900 billion. And one of every five civilian jobs was in the food and agricultural industry. Agricultural products rank first among all U.S. exports. Moreover, food costs to U.S. consumers, while rising, are among the lowest of any country in the world.

Food and agricultural research has contributed markedly in making the United States a giant of industrial enterprise. Research has given us new and better ways to improve production, processing, and marketing. In addition, agricultural research is solving problems in environmental quality and human nutrition. The aim of such research is to assure an ample, safe, and nutritious food supply at reasonable cost, while maintaining a sustainable production system. The United States is generally recognized throughout the world as a leader in agricultural research.

Despite its notable achievements, the U.S. food and agricultural research establishment today is facing new problems. These problems are exerting severe strains on our ability to meet current and projected challenges. Scientists are concerned that new technology may not be keeping pace with domestic and world needs.

The tight world supply-demand balance is also a growing problem. Unless major breakthroughs occur in either expanded resources or new technology, the world food problem is likely to worsen. Changes are also occurring in the structure of agriculture. For example, large farms and businesses have more influence than small farms on the direction public research programs take. New technology tends to be adopted more readily by larger and more mechanized firms than by smaller and less organized agricultural interests.

Recognizing this trend toward industrialization of agriculture, the Office of Management and Budget (OMB) has taken the stand that funds for some forms of public agricultural research are no longer needed. The implication is that the private sector has enough resources to conduct its own research. This argument has been used most specifically for post-harvest technology research. In the future, the argument might be expanded to other forms of technology-related food and agricultural research.

The 1970's brought a host of new public issues and concerns that will likely continue in the 1980's. These include food safety, environmental protection, nutrition, and increasing competition for water resources.

Today, there are additional pressing issues: sustainability of the present agricultural system, water shortages in the West, widespread droughts, excessive soil erosion, increased energy costs, and continued environmental concerns.

Because Federal research funding has not substantially increased in recent years, new research problems must be funded at the expense of traditional research. Moreover, the cost of conducting research has increased. Research today requires more sophisticated and costly equipment and support staff than 10 years ago. Thus, many research areas are receiving relatively much lower real funding today than earlier.

The U.S. Department of Agriculture (USDA) and the State agricultural experiment stations (SAES) have always had a close working relationship in food and agricultural research. As a general rule, USDA has been concerned more with national and regional problems, and the SAES with local and State problems. But over the years, the SAES re-

*An Assessment of the U.S. Food and Agricultural Research System, Office of Technology Assessment, Report OTA-F-155, December 1981.

search programs have grown to include problems of regional and national significance.

With the present structure of USDA, there is some question as to whether USDA has a national research program or merely a series of local and regional activities. Consequently, USDA and SAES appear to be working on seemingly indistinguishable problems. Many people, including Congress, have voiced concern that little, if any, overall planning and coordination of research exist, especially at top levels of administration. They question whether national issues are receiving adequate attention. Further, there seems to be much duplication and vying for funds.

Now, the question arises: How should these new issues and concerns be handled? Over the years, there have been many studies dealing with food and agricultural research. Most studies, such as the World Food and Nutrition Study, have concentrated on agricultural research priorities. These studies have identified the research that requires highest priority and the level of funds needed for the research. Few of these studies have looked into the structure of the research system. There has been little, if any, attempt to identify roles of research agencies or to seek solutions to the problems they face. In addition, there has been little, if any, attempt to classify research from a management perspective.

Congress and others have raised questions about the allocation of research resources and the mechanisms used to develop research priorities. Other issues of concern include the adequacy of research funding, the distribution of research benefits, and the quality of expertise and interest being brought to bear on identifying and conducting research.

These concerns led directly to a request from Congress for the Office of Technology Assessment (OTA) to undertake an assessment of the U.S. food and agricultural research system. Congress stressed that the assessment focus on the structure of the research system and that it complement previous studies which identified agricultural research priorities. The requests for an assessment came from the Senate Committee on Appropriations as well as the Senate Committee on Agriculture, Nutrition, and Forestry. The House Agriculture Subcommittee on Department Operations, Research, and Foreign Agriculture also endorsed the requests.

The objectives of this assessment are to:

1. evaluate the funding, benefits, and burdens of food and agricultural research;
2. determine the basis, scientific or otherwise, for the classification of research from a management perspective;
3. identify the roles of Federal, State, and private institutions in developing technologies for solutions to international, national, regional, and State or local problems;
4. examine the management, structure, and policies of USDA in the conduct of food and agricultural research;
5. evaluate methods by which the expertise and interests of Federal, State, and private research organizations can be brought to bear cooperatively in identifying priority research areas; and
6. provide public policy options for Congress that will maximize our research potential.

The working groups and advisory committee that prepared and reviewed the resource material for this assessment recognized the urgency for resolving the issues that characterize the present situation in the agricultural research sector. They were motivated by a deep concern for maintaining a strong and growing food and agriculture industry. It is hoped that the analysis of these issues and public policy options offered herein will provide a good starting point for increased effective use of the Nation's scientific capabilities and other research resources.

11-864 0 - 83 - 24

STRUCTURE OF THE RESEARCH SYSTEM

When it is working properly, the U.S. agricultural research system is tremendously effective. The participants*—USDA, SAES, and private industry—concentrate on mission-oriented research; that is, research directed toward solving identifiable problems, although the programs include some basic research activities. Most land-grant universities and many nonland-grant universities have strong discipline-oriented research programs in the basic sciences, such as physics, chemistry, and botany, that form the foundation of biological and physical sciences on which agricultural research is based.

Federal Research

USDA is the major Federal agency conducting agricultural research. It is also the lead agency for the coordination of all federally funded agricultural research. Through early 1981, the Science and Education Administration (SEA) of USDA was responsible for: 1) broad agricultural research policies and coordination and 2) an operating organization which had day-to-day management supervision over a number of offices including Agricultural Research (AR), Cooperative Research (CR), and Human Nutrition (HN).**

AR is responsible for most of USDA's in-house agricultural research. AR is accountable and responsive to Congress and the executive branch for broad regional, national, and international concerns. It is headed by an administrator located in Washington, D.C., and four regional deputy administrators, one located in each of the four SAES regions. Each region is subdivided into areas under a research area director (fig. 1). A national program staff (NPS) prepares an integrated budget and assists in technical planning and coordination. NPS has no direct line responsibility for program development, staff selection, or resource allocation.

CR is responsible for administering Federal funds that go to States for agricultural research. This includes formula funds, special grants, and competitive grants. Formula funds help to provide a stable and dependable base, ensuring a strong experiment station in each State. Grants provide an opportunity for researchers in nonland-grant universities, SAES, and other institutions to work on problems important to the agricultural industry.

Human nutrition research in USDA is carried out by six research centers. Research at all centers is directed to national concerns.

Through early 1981 the economics research program was conducted by the Economics and Statistics Service (ESS). In addition to research, its primary objective is the collection and analysis of economics data.*

State Agricultural Experiment Station Research

Over the years, the structure of SAES has changed little. Stations typically include a central station and headquarters, which is generally located on the campus of the State's land-grant university, and a number of branch stations located throughout the State (fig. 2). Stations are organized by departments according to the various scientific disciplines represented on their staffs, such as departments of animal science, entomology, plant pathology, etc. These departments usually are the same as those of the academic unit and, in

*A large number of Federal agencies and public and private institutions are also involved in U.S. agricultural research. This assessment, however, is concerned primarily with the traditional agricultural research system, which includes the USDA research agencies, SAES, and private industry. The 1890 schools, nonland-grant universities, etc., are discussed where most relevant, but no in-depth study was made of them. Forestry research is not included in this assessment.

**In June 1981, USDA announced a reorganization that eliminated the Science and Education Administration and established AR, CR, and Extension Service as separate operating agencies. Most of HN was merged into AR. USDA established an Office of Science and Education, which is to establish broad agricultural research policies, planning, and coordination.

*In June 1981, USDA announced a reorganization that eliminated the Economics and Statistics Service and established two separate agencies, Economic Research Service and Statistical Reporting Service.

Figure 1.—USDA Agricultural Research System

SCALE: US Department of Agriculture

most cases, also include extension. In many cases, USDA personnel are located in departments and participate fully in departmental activities. The chief administrative officer of each department typically reports three ways —to the dean, to the director of SAES, and to the director of cooperative extension service.

In the early 1900's, the station director reported directly to the president of the university. Today, most station directors report directly to the dean of the college of agriculture. This relationship of the SAES working with the land-grant universities and USDA provides a unique opportunity for graduate training of future scientists for research, teaching, and other State, Federal, and industry needs. In fact, it is by far the principal source of trained scientists.

Beginning in the 1960's, increasing amounts of non-State funding became available from agencies other than USDA. USDA funding remained stable or declined, and grants to some SAES scientists tended to draw them away from the State program toward the interests of individual scientists or the granting institution.

SAES-USDA Interaction

In many areas of agriculture research, there have long been closely knit cooperative relationships between SAES and USDA agricultural research. This relationship has been one of the strong points of the U.S. agricultural research system. Generally, it has resulted in scientists from each group developing respect for those from other groups. The major diffi-

Figure 2.—State Agriculture Experiment Station System

SOURCE: U.S. Department of Agriculture

culties that have arisen are at the administrative level. The root cause of nearly all of these difficulties appears to be centered around competition for limited funds, which tends to create problems in the roles of the two groups. At times, this problem seems to permeate the entire system.

Private Sector Research

Participants in the private sector include foundations, industry, and industrial associations. Private industry research is conducted in those areas that are of major concern to the firm, primarily from a profit standpoint. While reliable data are difficult to obtain, private industry's investment in agricultural research appears to be about three-fourths of that of the public funds spent by USDA and SAES combined. Industry research tends to favor the developmental aspects and continues to draw heavily on basic research conducted in the public sector.

There are some 400 American philanthropic foundations that award grants of $5,000 or more to performers of agricultural research. The nature and purpose of the grants vary with the interest and purpose of the granting foundations. Compared with the amount of funds available to the performers of agricultural research from public sources, the amounts provided by foundations are indeed modest. The decision to make each grant is based on policies established by the individual foundation's governing board.

Other Research Institutions

At least 10 Federal agencies other than USDA conduct or fund some kind of food and

agricultural research. In most cases, such research is complementary to that of USDA. It is conceived and operated to support the basic mission of the respective agency. In order to increase the effectiveness and productivity of Federal R&D agencies, Congress in 1977 mandated the establishment of the Committee on Food and Renewable Resources.

In 1890 Congress passed an act that granted certain Negro colleges and universities the same privileges as those provided by the Morrill Act of 1862. They are called the 1890 land-grant institutions and Tuskegee Institute. Under the 1977 Food and Agriculture Act, these institutions receive substantial amounts of formula-funded agriculture research funds from Federal sources. Their role is to meet the needs of those people whom the system was designed to serve through teaching, research, and extension.

The nonland-grant universities include private institutions and public State universities. The major expertise of the private nonland-grant universities lies in research in the basic sciences. They generally receive no direct continuing State or Federal assistance and support their research through government grants, endowments, and corporate grants and contracts. Competitive grant funding opens up an opportunity for the universities to be more involved in agricultural research. Large public State universities without agricultural programs have, in many cases, the same problems and interests as the private universities.

The publ State universities with agricultural programs perceive their role as providing teaching, research, and public service to their regions and States in accordance with missions and charters set forth by State legislatures. Most of them have evolved from teachers colleges and have a strong emphasis on undergraduate teaching. Their research tends to concentrate on local problems of a more applied nature and on projects for which corporate support is more available.

Most nonland-grant universities have no Federal or State charter for research. Financing, heavily dependent on contracts and grants, has lacked continuity and dependability. Because of the concentration on undergraduate teaching, funding generally has not provided sophisticated facilities and equipment for graduate teaching and research, except for a few outstanding private research institutions.

PROBLEMS AND POTENTIAL SOLUTIONS

Food and Agricultural Goals

The lack of well-defined and agreed-upon national goals for U.S. food and agriculture is a major deterrent in formulating broad food and agricultural policy at the national level.

A goal is the end toward which effort and resources are directed. The end must be definable and achievable at least in theory. Other than general goals of self-sufficiency, the United States has not had well-articulated national food and agricultural goals.

There are implicit goals, but they provide little help in formulating policies and giving direction to the research community. One implied goal is to provide an ample supply of nutritious food for the consumer at reasonable cost with a fair return to farmers within an agricultural system that is sustainable in perpetuity. However, this "goal" is open-ended and, therefore, not achievable. For example, what is meant by "ample supply?" What is nutritious food? What is a reasonable cost to consumers? What is a fair return to farmers? When is this return to be expected? How much soil erosion or dependence on fossil fuel can a sustainable system tolerate?

These and other questions must be answered for a goal to be useful in formulating policy and for the research community in planning a research agenda. With such questions unanswered, setting research priorities is a difficult task at best.

Roles of Research Participants

There is a role for a strong national USDA research program. This role has been carried out in the past by AR, HN, ESS, and Federal funding to SAES. The USDA role has been associated with broad regional, national, and international activities. The role of SAES, insofar as Federal funds are concerned, has been primarily for local, State, and regional problems. There has been considerable overlap; some portions of the Federal and State roles are becoming indistinguishable.

USDA's role is to conduct research on: a) agricultural problems important to the Nation, problems that no one State or private group has the resources, facilities, need or incentive to solve, and b) those programs required to fulfill stated objectives of Congress, the President, and the Secretary of Agriculture. USDA could carry out its role by: a) working as a partner with SAES to achieve complementarity and b) cooperating with private universities and industry to coordinate its own contribution to achieve national goals with minimum effort.

Most of the 1890 land-grant institutions and Tuskegee Institute research funds come from Federal resources and if they are to meet their obligations, pressing needs must be addressed. One important need is improved facilities. But an even more important concern is the future role of these institutions and their ability to compete for and maintain faculty and staff. While there is some cooperation with USDA and SAES, coordination with the system is less than adequate.

In 1977, Congress established the Committee on Food and Renewable Resources (CFRR) to improve coordination of the research activity of USDA and the 10 other Federal agencies involved in food and agricultural research. CFRR has not yet satisfactorily fulfilled its role. As of early 1981, CFRR did not have a classification of the food and agricultural research conducted or funded by these agencies nor the amount of funds allocated for such research. Identifying definite objectives for CFRR would be helpful. Further, CFRR lacks authority to carry out the functions assigned by Congress. USDA has an opportunity to take an aggressive leadership role in this area, but to be effective it will require high-level attention and support.

Grant funds provide resources to further the program of USDA. SAES, nonland-grant universities, and other institutions compete for these funds on the basis of their interest and ability to do Federal research. This broadens the base of resources for agricultural research.

The private sector tends to view its role primarily from a profit potential. It conducts research in areas of interest to the companies and in areas that may give them proprietary advantages. There are significant research areas of interest to the public that are not receiving nor are likely to receive adequate research attention if left to the private sector.

Research Priority Determination

There is no satisfactory long-term process for evaluating research activities, research opportunities, and development of research priorities. Decisions are made on an ad hoc basis with very little coordination among USDA, SAES, and other agencies conducting food and agricultural research. Long-term research planning, updated every 4 years or more, could be accomplished by an intensive study involving research administrators, scientists, users, and consumers.

Congress established the Joint Council on Food and Agricultural Science (JC) and the National Agricultural Research and Extension Users Advisory Board (UAB), which is made up of citizens, to aid in coordination and priority setting. These groups have struggled with their assignments. Concern exists as to whether the functions assigned to the JC are attainable. The council has had a limited impact because of: an inability to define its role, a perceived dominance by USDA, and overorganization. UAB's functions are more attainable than the JC's; however, the board's impact on research priorities is unclear. Neither of the units has the capacity to conduct a long-range systematic study of research priorities that involves scientists, research administrators, users, and others; neither was set up to do that.

Involvement of scientists and research administrators is needed for the obvious reason that they have the expertise and are the performers of the research. Research users are needed because they have specific problems that need to be addressed by research. Likewise, consumers have legitimate concerns that the research community needs to address.

Funding

USDA research expenditures are proportionately the smallest of any major Federal research agency. In 1978, USDA's share of Federal expenditures for research and development was 1.5 percent of total expenditures compared with the Department of Defense—45 percent, Department of Energy—16 percent, and Department of Health and Human Services—12 percent.

The purchasing power of total SAES and USDA agricultural research expenditures increased 23 percent in constant dollars from 1966 to 1979. The constant-dollar agricultural research expenditures of USDA increased 1 percent, while those of SAES increased 40 percent from 1966 to 1979.

Total expenditures by private enterprise for food and agricultural research are about three-quarters of the expenditures of Federal and State governments combined.

Justification of public funding of food and agricultural research is based on benefits well in excess of costs.[1] Issues of equity, because of the interstate flow of food and related commodities and the spillover effect of research from one geographic region to another, are also cited. Producers benefit from expanding demand and reduced costs. The distribution of consuming population among States, however, is related to the distribution of agricultural production only to a very limited degree. Paradoxically, Federal research funding, relative to State funding, has decreased as the interstate flow of commodities has increased. Therefore, taxpayers in food-surplus States are subsidizing consumers in food-deficit States and the degree of subsidization is increasing steadily.

[1] Fred White, B. R. Eddleman, and Joseph Purcell, *Nature and Flow of Benefits From Agriculture-Food Research*. OTA background report, 1980.

FEDERAL FUNDING FOR RESEARCH IN VARIOUS AGENCIES

Figure 8.—Federal Obligations for R&D by NASA, DOE, NSF, and Other Selected Agencies—1966-78
(in millions of current dollars)

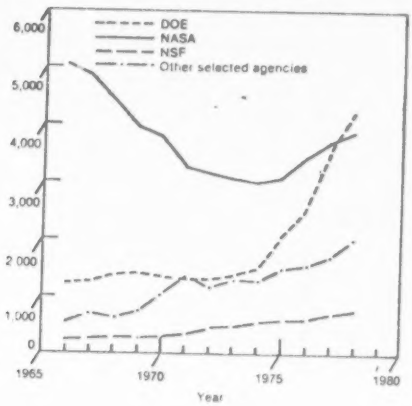


Figure 9.—Federal Obligations for R&D by NASA, DOE, NSF, and Other Selected Agencies—1966-78
(in millions of constant dollars)

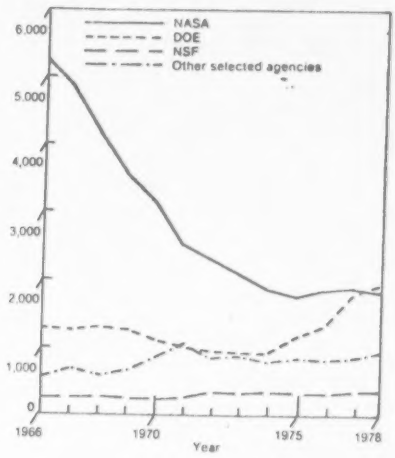


Figure 10.—Federal Obligations for R&D by USDA, DOD, HEW, and All Federal Agencies—1966-78
(in millions of current dollars)

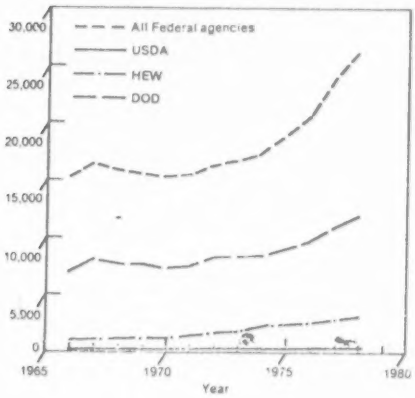
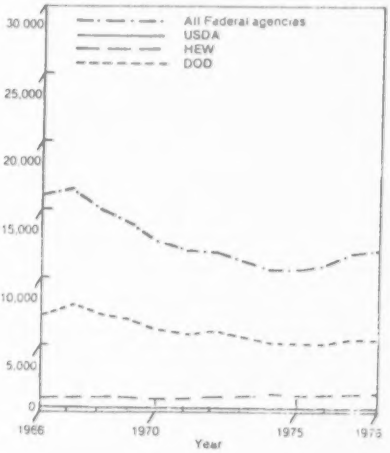


Figure 11.—Federal Obligations for R&D by USDA, DOD, HEW, and All Federal Agencies—1966-78
(in millions of constant dollars)



FEDERAL FUNDING FOR RESEARCH IN VARIOUS AGENCIES

Table B-3.—Research and Development Expenditures by Government Agencies (DOD, HEW, USDA, DOE, NASA, NSF, Other Selected Agencies and Total) at SAES and USDA—1966-78 (In thousands of current and constant dollars)

Year	DOE		NASA		NSF		Other agencies	
	Current	Constant	Current	Constant	Current	Constant	Current	Constant
1966	$1,212	$1,271.77	$5.050	$5.299.06	$244	$256.034	$ 541	$567.68
1967	1,257	1,257.00	4,867	4,867.00	262	262.000	694	694.00
1968	1,369	1,296.40	4,429	4,194.13	284	268.939	625	591.86
1969	1,406	1,260.99	3,963	3,554.26	274	245.740	744	667.26
1970	1,346	1,117.01	3,800	3,153.53	289	239.834	1,043	865.56
1971	1,303	1,009.30	3,258	2,523.63	337	261.038	1,357	1,051.12
1972	1,298	942.63	3,157	2,292.67	455	330.428	1,169	848.95
1973	1,383	925.95	3,061	2,079.48	480	326.087	1,288	875.00
1974	1,489	912.94	3,002	1,840.59	556	340.895	1,278	783.57
1975	2,047	1,153.24	3,064	1,726.20	595	335.211	1,486	837.18
1976	2,464	1,308.55	3,447	1,830.59	609	323.420	1,541	818.37
1977	3,536	1,761.83	3,703	1,845.04	697	347.285	1,695	844.54
1978	4,196	1,930.97	3,876	1,783.71	754	346.986	2,005	922.69

Year	DOD		HEW		USDA		Total	
	Current	Constant	Current	Constant	Current	Constant	Current	Constant
1966	$ 7,024	$7,370.41	$1,014	$1,064.01	$153	$160.546	$15,247	$15,999.0
1967	8,049	8,049.00	1,147	1,147.00	165	165.000	16,441	16,441.0
1968	7,709	7,300.19	1,252	1,185.61	159	150.568	15,827	14,987.7
1969	7,696	6,902.24	1,297	1,163.23	163	146.188	15,543	13,939.9
1970	7,360	6,107.88	1,221	1,013.28	177	146.888	15,236	12,644.0
1971	7,509	5,816.42	1,476	1,143.30	197	152.595	15,437	11,957.4
1972	8,318	6,040.67	1,751	1,271.60	224	162.672	16,377	11,893.2
1973	8,404	5,709.24	1,838	1,248.64	236	160.326	16,670	11,324.7
1974	8,420	5,162.48	2,290	1,404.05	240	147.149	17,275	10,591.7
1975	9,012	5,077.18	2,363	1,331.27	265	149.296	18,832	10,609.6
1976	9,655	5,127.46	2,546	1,352.10	303	160.913	20,565	10,921.4
1977	10,963	5,462.38	2,787	1,388.64	344	171.400	23,725	11,821.1
1978	11,825	5,441.79	3,132	1,441.33	381	175.334	26,169	12,042.8

SOURCE: NSF, Science Indicators 1979, "Table 4-2 Research and Development Expenditures by U.S. Government Departments, 1966-1978."

Table B-4.—Total Research Expenditures at SAES, USDA, and Combined SAES and USDA—1966-79 (In thousands of current and constant dollars)

Year	SAES		USDA		Combined SAES + USDA	
	Current	Constant	Current	Constant	Current	Constant
1966.....	$205,215	$215,336	$153,084	$160,634	$ 358,299	$375,970
1967.....	207,675	207,675	165,424	165,424	373,099	373,099
1968.....	242,687	229,817	159,150	150,710	401,837	380,527
1969.....	259,292	232,549	163,865	146,964	423,157	379,513
1970.....	282,101	234,109	176,896	146,802	458,997	380,911
1971.....	300,224	232,552	197,084	152,660	497,308	385,212
1972.....	346,942	251,955	224,308	162,896	571,250	414,851
1973.....	378,658	257,240	236,291	160,524	614,949	417,764
1974.....	430,609	264,015	240,183	147,261	670,792	411,276
1975.....	490,054	276,087	265,604	149,636	755,658	425,723
1976.....	527,120	279,936	302,531	160,664	829,651	440,601
1977.....	605,455	301,672	343,859	171,330	949,314	473,001
1978.....	662,533	304,893	380,556	175,129	1,043,089	480,022
1979.....	708,932	301,288	381,242	162,024	1,090,172	463,312

SOURCE: Compiled from USDA, Inventory of Agricultural Research FY1966-79, vol. II, Science and Education Administration.

Our agricultural success is based largely on adoption of technology developed through research. Indeed, the application of science to agriculture has significantly helped make the United States a giant of industrial enterprise.

Paradoxically, the United States has never had a well-articulated set of agricultural goals mandated by law. Yet throughout U.S. history, there have always been *presumed* goals that government has a responsibility for developing an ever-increasing array of new technologies that efficiently provide adequate food supplies. Because of this national philosophy, set in perpetuity, the United States has never been a hungry Nation—nor is it likely to be in the future.

To carry out the tasks of conducting food and agricultural research, the United States relies on Federal agencies, State agricultural experiment stations (SAES), universities, and private industry. Their research and development efforts and the resultant high production of American farms have assured consumers an ample supply of quality food at reasonable cost. The agricultural sector has been able to do this mainly because technological advances have produced the methods and tools to meet rising consumer demands.

Despite its continued notable achievements, the food and agricultural research establishment is facing new problems that are exerting severe strains on goal fulfillment. Of prime concern among scientists are indications that new technological developments may not be keeping pace with our needs.

Two events in the early 1970's raised doubts as to the ability to feed an ever-expanding world population. First, the Southern corn leaf blight in 1970 reduced corn production in the United States by about 16 percent. Second, the combination of unfavorable weather and purchasing strategies of centrally planned economies (such as Russia) led to an uncomfortably low grain stock and high prices from 1973 through 1975.

This combination of events resulted in several assessments of the world food situation and its ability to feed an ever-expanding population (NAS, 1975 and 1977; USDA, 1974 and 1979; U.N. World Food Conference, 1974). The consensus of these studies was: 1) world supply-demand balance was tighter in the 1970's than in the 1960's, 2) periodic spot shortages of food could be expected in years ahead and the potential for shortages could become increasingly severe, 3) more trade in agricultural products would be required to satisfy increasing demand for food, 4) government policies should be oriented toward obtaining increased production of food, and 5) need exists to give increased attention to the quantity and quality of resources available for food production, including the need for larger public and private expenditures for agricultural research.

There is a problem of an increasingly tight world supply-demand balance. Without major breakthroughs based on either an expanded resource base or technological developments, the world food problem is likely to become increasingly severe. Since development of a substantially expanded agricultural resource base is uncertain, technological change through research bears much of the burden for expanded food production.

Public support for food and agricultural research has been based on the public interest in an adequate and stable supply of food at reasonable prices. The concept embodies the maintenance of a sustainable resource base to assure a continuing supply for future generations. Realization has traditionally existed that farmers, as individuals or groups, have neither sufficient economic incentive nor scale of operation to conduct their own research programs. In addition, it was believed that the existence of a competitive agricultural structure would result in rapid adoption of new technology by farmers.

This justification for public support for agricultural research is still prominently used. While it still has merit, many changes have occurred in the structure of agriculture that can change significantly the distribution of benefits among input suppliers, farmers, marketing firms, retailers, and consumers. Reality suggests that: 1) large farms have more influence than small farms on public research programs, and 2) some food and agricultural research is not neutral with respect to structure—e.g., technology has been adopted more readily by larger and more mechanized farms than by small and less organized farming interests. The magnitude and effects of these changes have not been adequately evaluated.

Realizing this trend toward industrialization of agriculture, some members of the executive branch, including the U.S. Department of Agriculture (USDA) and the Office of Management and Budget (OMB), have in the past taken the position that it is no longer necessary to increase investment in certain forms of research. The implication is that proprietary firms have sufficient resources to conduct their own research. This argument has been used with respect to post-harvest technology research. In the future, the argument might be used for nearly all technology-related agricultural research.

In addition to food shortages and the continuing process of industrialization, the 1970's brought a host of new issues and concerns that will continue in the 1980's. Demand developed for more generous food programs, organization rights for farm labor, lower food prices, increased food safety, increased environmental protection, sharing water rights, and improved nutrition.

Today, there are pressing issues that should receive increased research attention. The sustainability of our agricultural system is being severely questioned. The United States is running out of water in parts of the West, droughts persist in much of the country, excessive rates of erosion on some of the most productive lands may prohibit maintenance of a sustainable system, increased costs of energy (fuel and fertilizer) threaten to price our products out of reach, and environmental concerns continue.

Concern exists within the food and agricultural research establishment that because there have been no substantial increases in research funding, this new agenda of issues has transferred and is transferring resources from traditional research interests associated with increasing production and efficiency. This is a legitimate concern, considering that Federal funds have remained relatively constant in terms of real dollar expenditures while the research base has broadened. In addition, the costs of conducting research have increased in real terms. Research today requires more sophisticated and expensive equipment and support staff than 10 years ago. Thus, with the expanded research base, accompanied by higher costs and constant funding levels, many research areas are receiving less funding today than earlier.

Historically, USDA and the SAES have had a close working relationship in U.S. agricultural research. USDA as a general rule has been more concerned with problems of national and regional importance, and the SAES with problems of a local and State nature. The land-grant colleges have grown into universities and generally have become large research institutions. Their research activities naturally have grown not only to include State and local problems but also to have significance on both a regional and national basis. Congress has provided SAES funds for regional research. However, as a result of the 1972 reorganization of the Agricultural Research Service in USDA, there is a question of whether USDA has a national research program or merely a series of local and regional activities. Consequently, USDA and the SAES appear to be working on seemingly indistinguishable problems.

This in itself is not necessarily bad if planning and coordination are appropriately used. But many people, including Congress, have come to believe that little, if any, overall planning and coordination of research exist, especially at top levels of administration, and question whether national issues are receiving adequate attention. There seems to be much duplication and vying for funds.

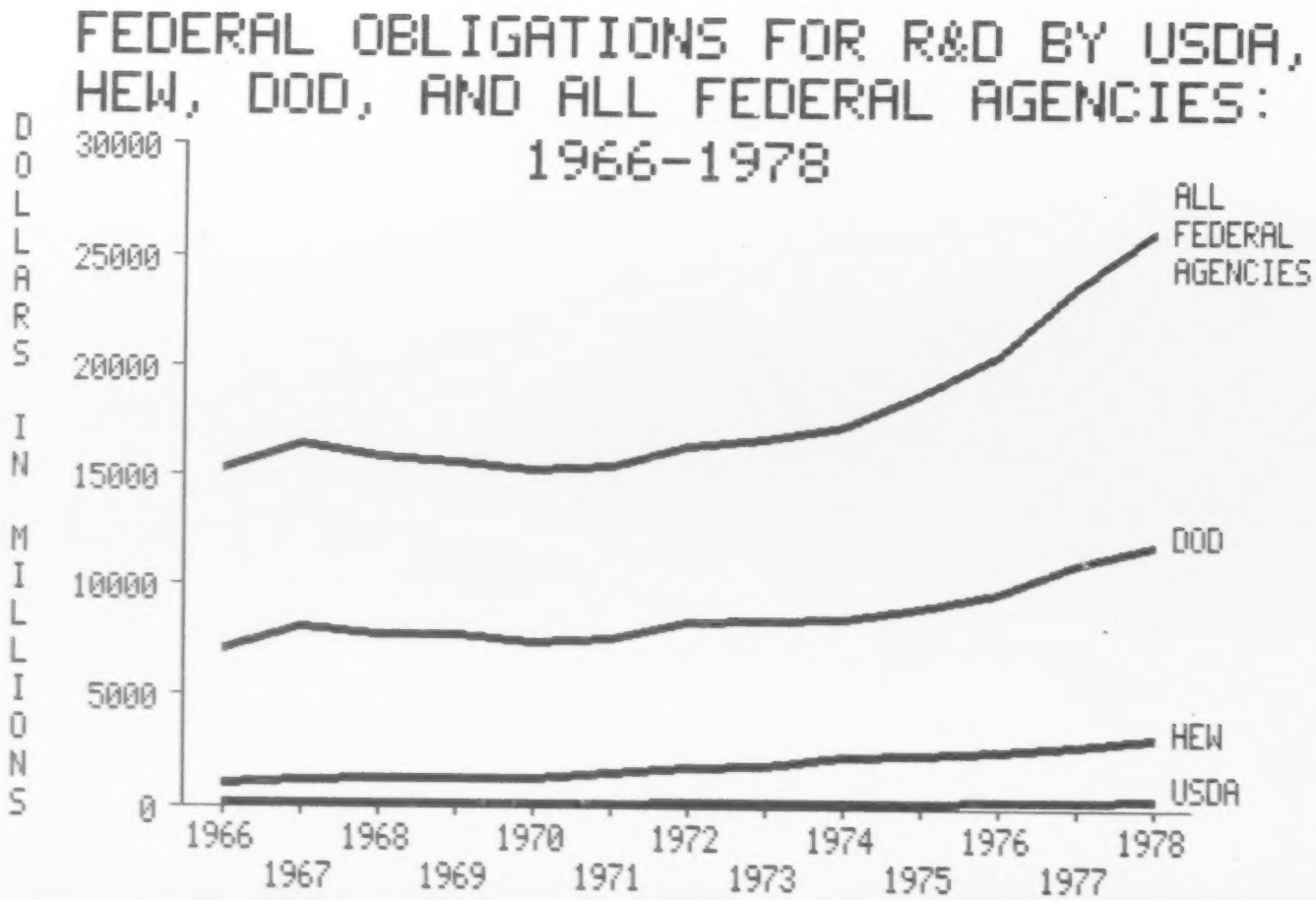
By 1977, it became apparent to congressional leaders that new steps were needed to upgrade agricultural research and coordination. As a result, the Food and Agriculture Act of 1977 directed the Secretary of Agriculture to establish: a) a committee known as the Joint Council on Food and Agricultural Sciences (JC) and b) a National Agricultural Research and Extension Users Advisory Board (UAB). Primary responsibility of the JC is to foster coordination of agricultural research, extension, and teaching activities of the Federal Government, the States, colleges and universities, and other public and private institutions involved in the food and agricultural sciences. UAB is responsible for preparing independent advisory opinions on the food and agricultural sciences.

There have been many studies that have dealt with food and agricultural research. They include reports by the President's Science Advisory Committee (1962), the Committee on Research Advisory to the USDA (1972), the Agricultural Production Efficiency Study (1975), the World Food and Nutrition Study (1977), and USDA's Study of Agricultural and Food Research Issues and Priorities (1976). This latter study reviewed 50 reports and studies dealing with priorities for food and agricultural research. Thirty-two of the reports addressed the inadequacy of funding of agricultural research and called for its strengthening. Few of these studies have addressed the structure of the research system. No attempt has been made to define local, regional, and national problems on a scientific basis in order to assign research responsibilities. Nor has there been any attempt to [illegible] roles of those agencies and institutions participating in domestic and international research or to seek solutions to the problems they face. The question still arises as to the adequacy of the funding level for research, the distribution of the benefits of research, and the quality of research. In addition, there is the question as to whether present methods are satisfactory by which expertise and interest of Federal, State, and private organizations are brought to bear on identifying and conducting research.

Hence many, including Congress, have become concerned over the allocation of resources to various domestic and international research activities and the mechanisms used for development of research priorities. Within the U.S. food and agricultural research system, there appears to be a dichotomy of professed procedures for priority setting and actual practices. Need for a sound, workable process became apparent in order to maintain continuity in planning and to keep the research system viable.

ABBREVIATIONS

AR	-Agricultural Research in SEA (USDA 1977-81)
ARS	-Agricultural Research Service (USDA 1953-77, 1981-)
CFRR	-Committee on Food and Renewable Resources
CR	-Cooperative Research in SEA (USDA 1977-81)
CSRS	-Cooperative State Research Service (USDA 1962-77, 1981-)
ESS	-Economics and Statistics Service (USDA 1977-81)
HN	-Human Nutrition in SEA (USDA 1977-81)
JC	-Joint Council on Food and Agricultural Sciences
NAS	-National Academy of Sciences
NPS	-National Program Staff, USDA
SAES	-State Agricultural Experiment Stations
SEA	-Science and Education Administration (USDA 1977-81)
UAB	-National Agricultural Research and Extension Users Advisory Board


FEDERAL OBLIGATIONS FOR R&D BY USDA, HEW, DOD, AND ALL FEDERAL AGENCIES: 1966-1978
DOLLARS IN MILLIONS
30000
25000
20000
15000
10000
5000
0
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
ALL FEDERAL AGENCIES
DOD
HEW
USDA

UNITED STATES DEPARTMENT OF AGRICULTURE

JOHN R. BLOCK
SECRETARY

ASSISTANT SECRETARY
FOR
SCIENCE AND EDUCATION
T.B. KINNEY, ACTING

- NATIONAL AGRICULTURAL LIBRARY
  - F. A. FARLEY, DIRECTOR
- EXTENSION SERVICE
  - M. N. GREENWOOD, ADMINISTRATOR
  - COOPERATIVE EXTENSION PROGRAMS IN ALL STATES
- COOPERATIVE STATE RESEARCH SERVICE
  - W. I. THOMAS, ADMINISTRATOR
  - STATE AGRICULTURAL EXPERIMENT STATIONS (SAES)
    - 1890 INSTITUTIONS, FORESTRY SCHOOLS, AND COLLEGES OF VETERINARY MEDICINE
  - OTHER COLLEGES, UNIVERSITIES AND RESEARCH ORGANIZATIONS THROUGH COMPETITIVE RESEARCH GRANTS
- AGRICULTURAL RESEARCH SERVICE
  - T.B. KINNEY, ADMINISTRATOR
  - IN HOUSE AGRICULTURAL RESEARCH PROGRAM